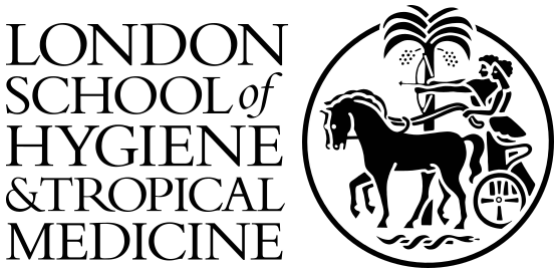

Household survival and changes in characteristics of households in rural South-western Uganda through the period of 1989 to 2008

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ACRONYMS

- **DSA**: Demographic Surveillance Area
- **DSS**: Demographic Surveillance System
- **FLC**: Family Life Cycle
- **FP**: Follow-up Period for longitudinal analysis that can be short-term (annual) or long-term (four to five year) follow-up
    - **LFP:** Long-term Follow-up Period
    - **SFP**: Short-term Follow-up Period
- **FU**: Family Unit
    - **CFU**: Conjugal Family Unit
    - **SFH**: Simple Family Household
    - **EFH:** Extended Family Household
    - **MFH**: Multiple Family Household
- **GPC**: General Population Cohort
- **Household structure**: Description of a household's characteristics – could be the composition or family relationships in the household
- **RCC**: Rural Clinical Cohort
- **SES**: Socio-Economic Status

A B S T R A C T

Background

A better understanding of household dynamics has become increasingly important as researchers consider the broader impact of HIV on communities. This has led to the need for longitudinal investigation of household response to HIV infection.

Objectives

Using the General Population Cohort (GPC) household data collected between 1989 and 2008 in rural South-west Uganda, households are traced over time. Structurally classified, overall household behaviour (dissolution, migration and structural change) is observed. Whether and how adult HIV infection or mortality alters the overall household patterns is investigated.

Methods

The GPC households were retrospectively traced between 1989 and 2008. For each year, households are classified to identify children (<15 years), "middle-aged" (15-59 years) and "older" (≥60 years) adults, or according to family relationships of residents to the household head. Cross-sectional and longitudinal analyses of household survival and structural change patterns are undertaken.

Results

Least household dissolution or migration ('stable') is observed in extended, households with a couple with children; or those with a child, middle-aged man, middle-aged woman living with or without an older adult. The overall patterns show households transitioning to these stable structures over time through reproduction, marriage, individual growth, and individual in-migration.

However, household head or spouse HIV infection hinders this transition particularly promoting couple separation; being a barrier to reproduction; or increasing the out-

migration of non-productive residents (dependants) eventually increasing cases of household non-survival (dissolution or migration).

Household head or spouse death results to widowed heads which corresponds to an increase in migration of initially stable households. Alternatively other adult resident HIV infection or mortality promote household growth and increased household survival.

Conclusion

With the GPC households traced, longitudinal household investigations are possible. This enables a better understanding of how HIV infection and adult mortality influence household dynamics.

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1 INTRODUCTION

1.1 Introduction

Families and households, like other social institutions, are dynamic and not static entities. As a fluid set of relationships, they constantly evolve as they experience events such as household member movement in or out of the household, household member growth in age, births, deaths, marriage, divorce/separation, or whole household relocation. As a result households migrate, change their structure or dissolve. Some of the restructuring and reshaping of households are usually in response to wider social and economic factors for example education or job opportunities; or threats such as famine, drought, loss of income (for example due to loss of employment, low crop yields or fish stocks), war, illness and deaths in the household (Mathambo and Gibbs, 2008). The AIDS epidemic ranks high as a cause of changes in household and family arrangements (Chirwa, 2002, Abebe and Aase, 2007, Mathambo and Gibbs, 2009). In addition, the household responses to these factors has been observed to differ according to the characteristics of the households such as socio-economic status, size, composition or intra-household relations (Bharat and Aggleton, 1999, Adams et al., 1998).

The knowledge of household dynamics can therefore play a crucial role in explaining social and demographic patterns within households and in observing the overall population patterns of disease. Due to this, researchers have become increasingly interested in investigating household dynamics. However, an effective investigation of household dynamics requires the observation of households over time in longitudinal studies. Unfortunately, this is rare mainly because of the high costs of carrying out such studies. Alternatively, cross-sectional studies at different time points, or relatively small cohort studies have been undertaken with many of these concentrating on individuals rather than households.

In response to the great interest in the demographic impact of the HIV epidemic on households by use of longitudinal household information, this thesis handles the challenge of developing rules to retrospectively link annually collected household information to

enable longitudinal household investigations. This is done by taking advantage of an annual surveillance of individuals undertaken in south-western Uganda under the General Population Cohort (GPC) since 1989. Developed are techniques to trace households over the 19 years to 2008.

As observed by Bharat and Aggleton, and Adam et al (Bharat and Aggleton, 1999, Adams et al., 1998), household dynamics are influenced by the household's characteristics especially the characteristics of the residents, their family relationships and the household socio-economic status. The second step in the thesis is therefore to observe if the dynamics of the GPC households are influenced by their characteristics. This is done by first identifying ways to classify the households by their characteristics, then observing the household dynamics that is household dissolution, migration, and changes in the household types. A household's non-survival is represented by household dissolution or migration. This provides an understanding of which household types are more or less likely to dissolve and more or less fluid in their household memberships. Building on this, the impact of adult HIV infection and adult mortality on household survival and change in the structural characteristics is investigated.

1.2 Description of the General Population Cohort

The GPC is a community-based project that has been carried out in a rural sub-county in Kalungu District, in south-western Uganda since 1989 by the Medical Research Council/ Uganda Virus Research Institute on AIDS in Uganda (MRC/UVRI). The cohort was mainly established to study the dynamics of HIV infection in the rural population, identify the major risk factors of contracting HIV, quantify the impact of HIV infection on mortality and fertility; and study treatment-seeking behaviour. To achieve this, since 1989, annual demographic, medical and serological surveys have been undertaken. In addition, information on the socio-economic status based on house construction and a weighted asset index has been collected every four years.

At the start of the cohort, the study covered 15 villages, and 10 neighbouring villages were added in the 2000 as shown in Figure 1. An attempt was made to ensure that the additional villages (referred to as 'new' villages) were similar to the 15 original villages (referred to as 'old' villages), but this was not completely possible, the major difference being the presence of the main trading centre in the new villages (Shafer et al., 2008). Mbulaiteye (2002) found the villages around the trading centres characterised by increased trading activity and individual mobility. The differences in household dynamics by household location in the old or new household, is investigated in the thesis.

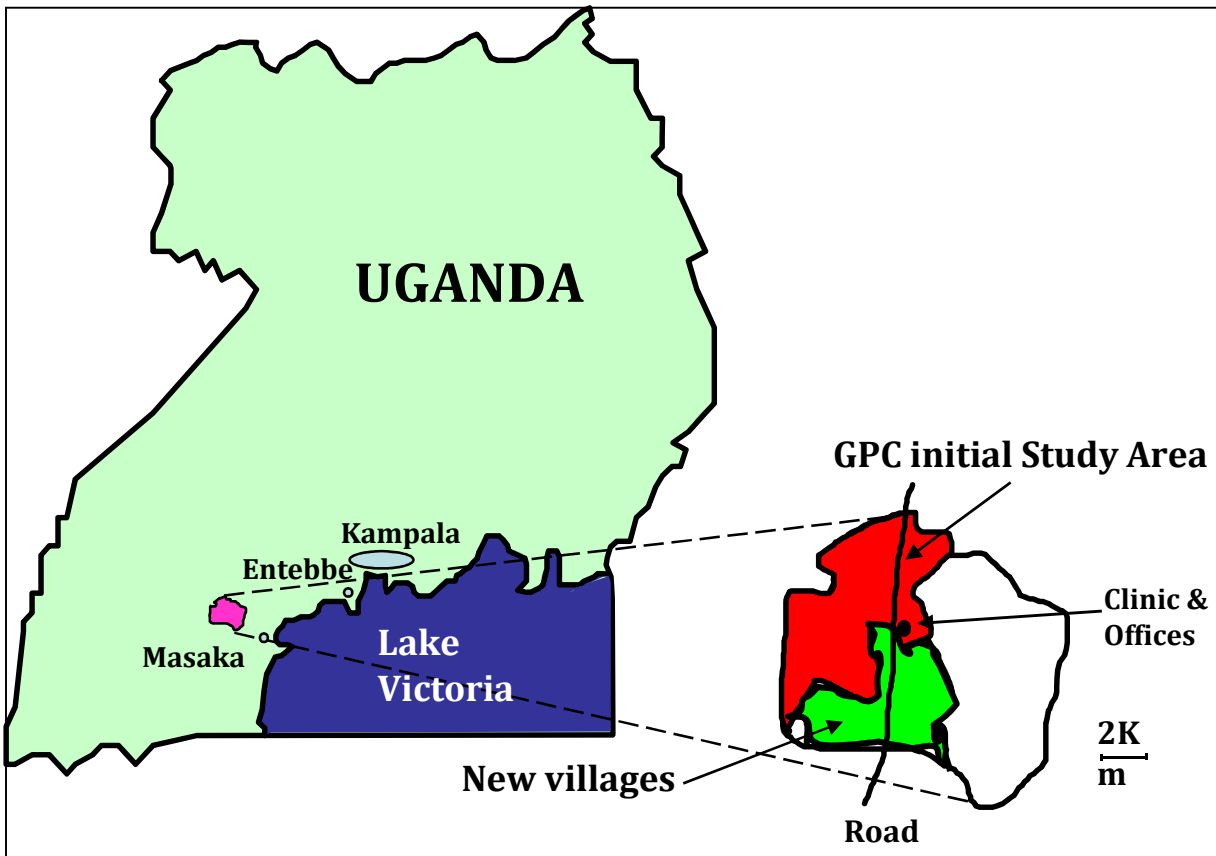

Figure 1: Map of Uganda showing the location of the Study setting

1.2.1 The mapping exercise

Each GPC survey begins in November and ends in October the following year. At the start of each survey, the people residing in the study area are informed of the forthcoming data collection. This is followed by a mapping exercise where a person referred to as the 'mapper' hand draws maps (upgraded to using the Geographical Positioning System (GPS) after 2008) locating all the dwellings and demarcating village boundaries and principal geographical features within the study area. In addition, all the households and the household residents are listed and assigned identification numbers. An individual who has lived in the household for at least three months or is intending to stay for more than three months is listed as a resident of a household and assigned a unique number.

1.2.1.1 Assigning household identification numbers

With the villages coded from 1 to 25, the first time a household is seen, an identification number is assigned in reference to the village in which the household is located and the sequence number on the household list in the village. For example a household listed 5th in village 14 would be assigned an identification number 14005. In the surveillance survey periods that follow, the household maintains this identification number if it remains in the same location. If the household relocates, then a new identification number is assigned in reference to the new location.

1.2.1.2 Assigning individual identification numbers

Individuals are also assigned an identification number based on the household they are living in when first seen. For example an individual listed first on the resident list of household 14005 is assigned identification number 14005001. The next resident is assigned 14005002 and so on. The listing of the household members usually starts with the member recognised as the head of the household. Unlike the household identification number, the individual identification number is maintained irrespective of whether the person changes location or household. This is assignment of household identification was based on research aims at the establishment of the GPC. In-fact, these research aims included no intentions of

looking beyond where the individual HIV infection occurs on the basis of relationships, sex and age and to explore residential units and demographic change.

In cases where an individual is resident in more than one household when first seen, the mapping team chooses the most appropriate identification number to ensure that each individual has only one unique identification number. In the subsequent years, identification is made of the new household residents and identification numbers assigned appropriately. For those that would have been registered in the study in the previous surveys or in the present survey but in another household, the initially assigned number is maintained. However for the residents being registered for the first time a new identification number is assigned based on the previously assigned number of household residents continuing the sequence of the last assigned resident. For example if the last number assigned to the residents of household 14005 was 14005008, then the new resident will be assigned 14005009 irrespective of whether some of the individuals assigned numbers 14005001 to 14005008 are not resident at the time the new resident is listed. It should be noted that, an individual maintains the number assigned the first time he/she is identified in the study irrespective of whether the individual stays, relocates or changes households.

To ensure consistency in the assignment of individual identification numbers, during mapping exercises the mapping team carries the household and individual list from previous surveys.

1.2.2 Data collection

1.2.2.1 Data instruments

Before collecting any information, informed consent is requested from all adult participants and from the caretakers of minors. This is followed by a household visit during which a census questionnaire is administered to the head of the household or an adult household representative. The questionnaire is used to collect demographic information (that is age, sex, marital status, tribe and religion) on the household residents. The information includes resident movements (joining or leaving the household), births or deaths that have occurred between surveys and the family relationships between the household members.

Also administered is the medical questionnaire collecting information on illness and treatment, pregnancy and births, family planning, sexual behaviour, condom use, and ART. Blood tests are also done on those who consent (which has been approximately 83% of individuals resident in participating households in a survey). Blood samples are taken annually during the medical survey from all residents aged 13 years or over who consent to several medical investigations including HIV testing. Those with an HIV-positive result for two consecutive surveys have no HIV test done on the subsequent blood samples drawn. This adds to the missing results in the dataset alongside those who did not consent to blood tests or were unavailable when the medical team visited the household.

As part of the medical survey free medical services and treatment have been provided to all study participants at the point of data collection or at the study clinic located in the study area. To assess the internal validity of the data collected, repeat interviews are held in a random sample of 10% of the households.

In addition, household socio-economic status (SES) information based on house construction and a weighted asset index is collected every four years using the house questionnaire. With the information collected varying from one survey to next, the commonly collected information includes:

- items owned by the household, including a jerrycan for carrying and storing water, a pot for boiled water, a dish-drying rack, bed(s), a mosquito net, a sewing machine, a working radio, a working radio cassette player, a bicycle in working condition, a motorcycle, a motorised vehicle, and a bus/lorry.
- materials used in house construction for roofing (grass, iron sheets, or tiles) and walls (grass, cow dung + sticks + figs, or bricks)
- access to a kitchen, toilet, latrine and source of water
- the number of rooms in the house
- the amount of land available to the household, most commonly for cultivation

Due to the inconsistencies in the information collected from one survey to the next, investigations involving SES are done in reference to the first GPC survey (undertaken 1989/1990). For the investigation, seven SES indicators are generated:

1. Household items: with 12 items identified, the availability of each item is given a score of 1 and unavailability given a score of 0, such that for example if a household has 7 of the 12 items, the household gets a score of 7. One would argue that some items should weigh more than others, for example the ownership of a bus/lorry should weigh more than the ownership of a jerry can. However I realised that if a household owned the most expensive item, they also owned almost if not all the less expensive items. Thus the count of the household items being appropriate. The maximum number of items owned by a household was 9 items.
2. Building materials: These were classified as poor, less poor and rich as follows:
    a. 'poor' if the roof and walls materials are grass, or if the roof is of grass and the walls of cow-dung + sticks + figs;
    b. 'less poor' if walls are of cow-dung + sticks + figs and the roof of iron sheets, or the walls are of brick and the roof of grass;
    c. 'rich' if the walls are of brick and roof of iron sheets or tiles.
3. Number of rooms: this was the count of the number of rooms allocated to the household
4. Facilities: with 4 facilities investigated (kitchen, toilet, latrine and source of water), a score was given for the availability of the facility with the scores ranging from 0 to 4
5. Land size: the size of land owned by the household in acres
6. Number of people per room (number of rooms divided by the number of people in the household). However to ensure that the measure depicts an indicator of low to high SES, I generate an inverse such that fewer people per room have a higher score.

The investigation of a correlation between the 6 SES indicators shows some correlation between indicators 1, 2, 3 and 4. The further use of factor analysis reduces the 6 indicators into 3 factor scores. However since the use of the SES indicators will be used to account for SES and not to observe the effect of household SES, I opt to use include all the 6 indicators in the model.

Table 1: Correlation coefficients of the 6 SES indicators

	1	2	3	4	5	6
1	1					
2	0.367	1				
3	0.3679	0.4829	1			
4	0.4143	0.3175	0.3318	1		
5	0.0845	0.1168	0.1707	0.0765	1	
6	0.1633	0.0751	-0.1737	0.1352	0.0243	1

1.2.2.2 Description of the participants

The annual surveys have so far been accepted well by the population collecting information from over 11,500 individuals living in the old villages and 6,200 individuals in the new villages during any given annual survey (a total of 42,969 have participated in the study at least once between 1989 and 2008). This has corresponded to visiting approximately 2,100 households in the old and 1,300 households in the new villages per annual survey. Over 50% of the population are under 15 years of age and 6% over 59 years. Sex distribution is fairly even with 49% male. The study participants are largely small-scale farmers producing mainly subsistence crops but also a few cash crops such as bananas, beans and coffee. Most of the population is ethnically Baganda (74%), but there is a large representation of immigrants from Rwanda (15%). The main local language is Luganda which is spoken and understood by all the tribes. The community is predominantly Christian (71%): Roman Catholics make up 58% and Protestants 12%. Twenty-eight per cent of the population is Muslim.

Of the 42,969 individuals, 79.5% (34,169) had an HIV test at least once during the study period with 4.7% of them testing HIV-positive. However consent for HIV testing was requested from only those aged over 13 years although some 13 years and below were tested on request for the children's guardians. This led to over 61% (20,846 individuals) of the tested individuals aged 13 years or under at the time of the first HIV test. A total of 13,323 participants (39% of the tested individuals) were aged over 13 years at the time of the first HIV test for the GPC of whom 10.3% tested HIV-positive (at this first test).

Table 2: HIV testing of the individuals that participated in the study between 1989 and 2008

Individuals that participated in the study atleast once between 1989 and 2008	
Number of individuals (**A**)	42,969
Individuals that had an HIV test at least once between 1989 and 2008	
Number of individuals (**B**)	34,169
Percentage [**(B/A)*100**]	79.5
Individuals aged 13 years or under at first HIV test	
Number of individuals (**C**)	20,846
Percentage of tested [**(C/B)*100**]	61.0
Individuals aged over 13 years at first HIV test	
Number of individuals (**D**)	13,323
Percentage of tested [**(D/B)*100**]	39.0
First HIV test is positive by age at first test	
Aged 13 years or under	
Number of individuals (**E**)	228
Percentage of those aged 13 years or under at first test [**(E/C)*100**]	1.1
Aged over 13 years	
Number of individuals (**F**)	1,366
Percentage of those aged over 13 years at first test [**(F/D)*100**]	10.3

Averaging across the 19 surveys (Figure 2), the percentage of female individuals that were HIV-positive (3.6%) was higher than the male individuals that were HIV-positive (2.8%). In addition, those living with HIV infection were more among those aged between 15 and 59 years.

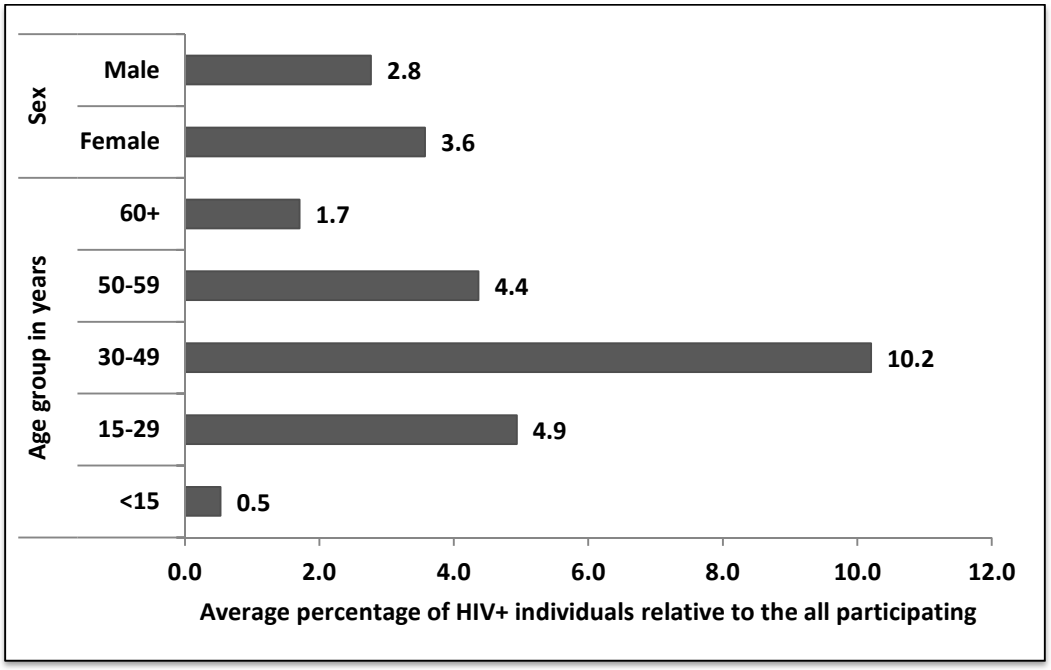

Figure 2: Percentage of HIV+ individuals relative to all participating individuals averaged across the 19 surveys

However, a total of 2,673 deaths were reported in the GPC between 1989 and 2008 of which 25.8% had an HIV-positive result. In addition, over 48% of the HIV-positive participants who died were aged between 30 and 49 years while 29% were aged between 16 and 29 years (Figure 3).

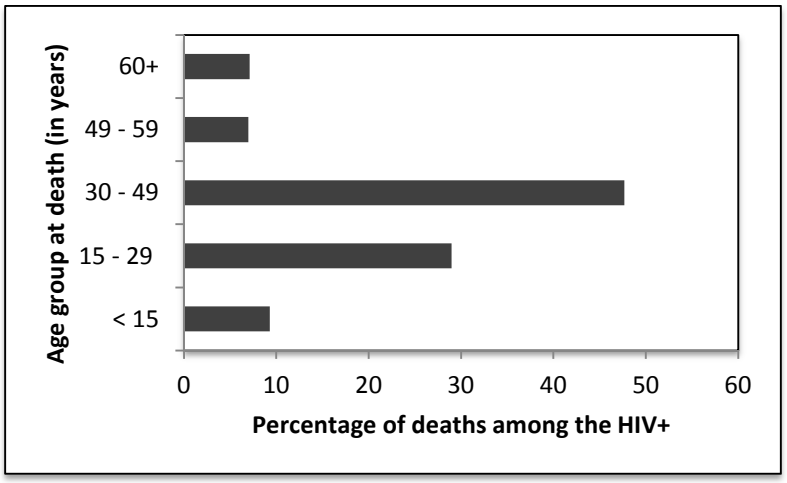

Figure 3: Distribution of HIV+ participants by the age of the participant at death

A further observation of deaths between survey periods (Figure 4) showed a reduction of the deaths among the HIV-positive after 1995 (with the spike after 2000 resulting from the inclusion of additional villages in the study).

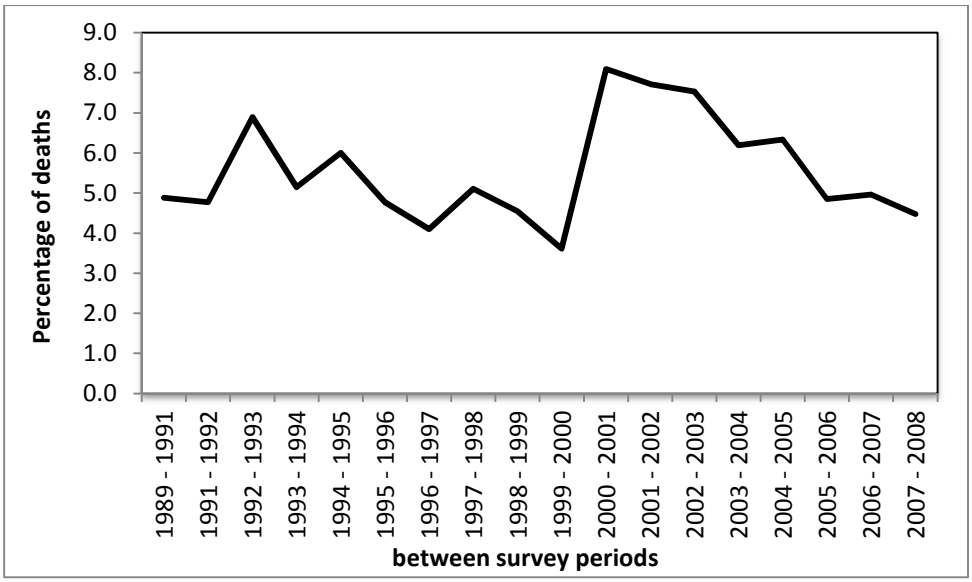

Figure 4: Distribution of deaths recorded between surveys among the HIV+ participants

The reduction in the number of deaths could be attributed to the free ART offered to the HIV-positive participants enrolled in the Rural Clinical Cohort (RCC), a study that started in January 2004 (Medical Research Council/Uganda Virus Research Institute-Biennial Report 2010-2011). In addition to the RCC, GPC information has enabled many studies of the evolution of the HIV epidemic over the years from the early ones such those by Seeley et al. and Mulder et al. (Seeley et al., 1991, Mulder et al., 1994, Mulder et al., 1995) to the recent one by Asiki et al. (2013). This thesis focuses on the demographic and relational information reported in the census questionnaire and the HIV test results reported by the medical survey from 1989 and 2008. A brief look at the basic indicators of household socio-economic status is also undertaken using some of the information on residential conditions, household assets and the essential facilities available to the household residents.

1.2.3 Data limitations

1.2.3.1 Movement status of residents

As illustrated in section 1.2.2, part of the information collected in the census questionnaire is the residential status of the household residents in reference to the previous survey identifying whether the resident moved in or out of the location, was born or died. For those who moved out, the new location is provided. However in some cases, this new location is recorded unknown and cannot be differentiated from those that refused to participate. In addition, the status of individual movement (especially for the household head) is a major determinant of the household survival particularly whether the household dissolved or migrated as illustrated in Chapter 2. This therefore means household refusal to participate cannot be differentiated from the households whose status is unknown (overall, these households are referred to as households lost to follow-up in the thesis).

1.2.3.2 Identification of multiple households or polygamy

Using identification of the principal household resident(s) to determine a household (as illustrated in Chapter 2) it is possible to identify multiple households as either households with multiple locations or multiple households resulting from polygamy (as long as they are headed by the same person). However this aspect is not included in the analysis. Instead each household is considered as a unique household. This is mainly because this aspect is not particularly taken into consideration during the data collection and using this information to particularly define polygamy may provide incomplete information.

1.2.3.3 HIV information and AIDS deaths

As stated in the description of the GPC study, for participants with an HIV-positive result for two consecutive surveys, no additional HIV tests were done on samples drawn in the survey periods that followed. This means that the dataset shows a missing HIV record for these individuals corresponding to these surveys. However, this missing information cannot be differentiated that attributed to consent not given or unavailability of the residents when the medical team visited the household.

In an attempt to minimise this missing data during analysis, a missing after an HIV-positive result is updated to an HIV-positive result; and a missing before an HIV-negative result is updated to a HIV-negative result. Since the analysis of the HIV information in this thesis is at household level, the bias introduced by this data update, especially as a result of the backward updates, will be minimal.

The data used also provides no distinction between an HIV-positive person who has developed AIDS and one who has not. The only extreme outcome of HIV infection assumed in this study is the death of one known to be HIV-positive with the assumption that the death was due to an AIDS-related illness.

Despite the knowledge that ART is undertaken or offered to some of the participants, this information was not available for this study.

Finally participants in the GPC study were offered free medical care including free ART for the selected HIV-positive participants. This could have resulted in non-residents falsely claiming to be residents to get the medical care resulting in an overestimation of the GPC participants particularly the HIV-positive participants.

1.2.3.4 Socio-economic status (SES)

As stated in section 1.2.2, the SES information is mainly based on house construction and a weighted asset index and collected every four years and varies from one survey period to next. Due to this limitation the comparison of a household's SES between two survey periods cannot effectively done. Therefore in the investigations involving SES, only the first survey was selected to measure a household's SES and the investigations related to this survey period.

1.3 The objectives of this study

Targeting the major objective of investigating the demographic impact of the HIV epidemic on households, the first challenge of this study is to develop a technique of retrospectively linking 19 annual surveillance surveys conducted in rural south-west Uganda. This will

enable longitudinal investigations of how households evolve over time, against a background of moderately high adult HIV prevalence.

The study then identifies ways in which a household could be classified according to the characteristics of the residents creating a household's structure that represents the household's age-sex distribution and the family relationships between the residents (family structure). Bringing these two together will enable the analyses of household dynamics in the forms of household dissolution, migration, and structural changes. This provides an understanding of which household types were more or less likely to dissolve and more or less fluid in their household membership.

Building on this, the impact of adult HIV infection and adult mortality on household survival and structural change is investigated. This thesis therefore has three broad objectives presented fairly independently in four separate chapters. Structured in a research paper format, each chapter is presented with its own literature, analysis, interpretation of results and conclusion.

1.3.1 Objective one

The identification of the GPC households during data collection was dependent on location such that the identification changed when the household changed location. To uniquely trace households from one survey to the next, a household had to maintain a unique identification even after changing location. Assigning this unique identification is the first objective of the thesis presented in Chapter 2. This includes retrospectively tracing the annually-visited GPC households from one survey to the next for the 19 surveys from 1989 to 2008.

Observing the behaviour of the GPC households from one survey to the next and relating work done by other researchers (though rare), I construct a set of rules to retrospectively trace households from one survey to the next. This tracing exercise enables the determination of whether a household has dissolved, migrated out of the study area, changed location within the study area, remained in the same location or has been lost to follow-up (status of household unknown).

1.3.2 Objective two

With the households traced, the second objective is to undertake a univariate analysis that investigates the overall household structure and household dynamics (survival and structural change) over time of the GPC households. This is done by first classifying the households by their characteristics (creating a household structure) and then determining:

- the distribution of the household by their structure
- whether there is an association between the household's structure and household dissolution or migration
- patterns of the changes in the household structure over time

This investigation is presented in two chapters, chapters 3 and 4. In Chapter 3, households are classified by the characteristics of the residents (household composition), most importantly the age and sex distributions of the residents and the specific age, sex and marital status characteristics of the household head. In Chapter 4, the households are classified by the family relationships within the households in reference to the household head.

1.3.3 Objective three

Building on univariate analyses undertaken in Chapter 3 and Chapter4, a multivariate analysis is undertaken to determine the impact of adult HIV infection and mortality in the household dynamics. As presented in Chapter 5, this is done by introducing the aspects of adult HIV infection and adult mortality to explore whether the HIV/AIDS epidemic is causing a change in household dynamics and in what direction. Also considered in the analysis is the households' structure and wealth status which could have an impact on household dynamics.

All the findings in chapters 1 to 5 are then pulled together in Chapter 6 where a discussion and conclusion of the thesis outcomes is presented.

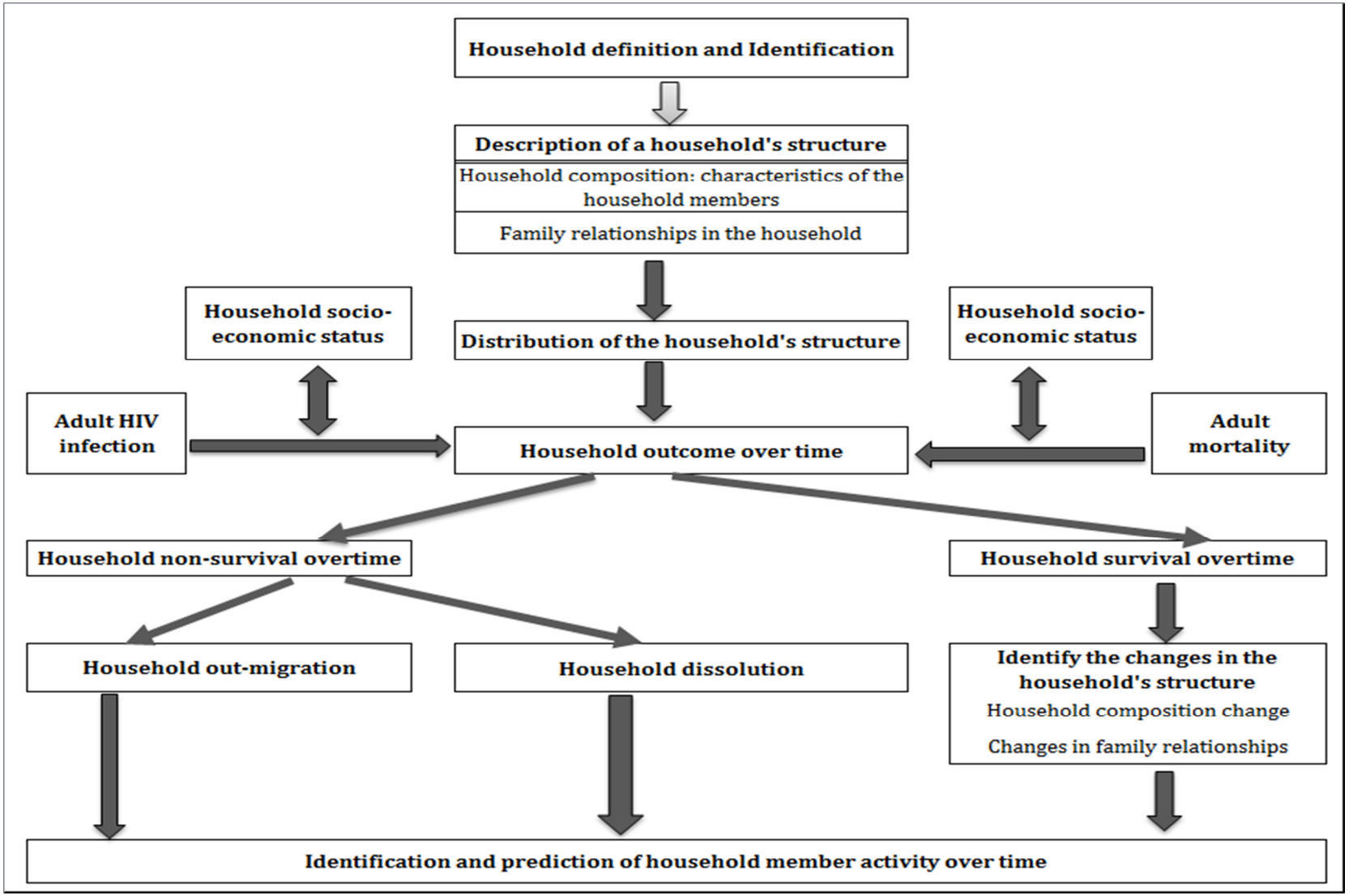

Figure 5: The study conceptual framework

1.4 The analysis plan

1.4.1 Tracing households

The first task in this thesis is to retrospectively trace households from 1989 to 2008 by assigning a unique identification to each of the households that participated in the study. This is identifies the status of the household from one survey to the next that is whether the household remains in the same location, migrates within or outside the study area, or dissolves.

I started this task by first looking at the first four surveys taking one household at a time to observe the unique household behaviour from one survey to the next. This was done by using the census questionnaire information on the household members specifically their relational information, movement status including movements in and out of the household, births and deaths, and in some cases marital status. The different observations were then used to create a set of rules for tracing households from one survey to the next giving each household a unique identifier that remained unchanged irrespective of the survey. The data management exercise was done using the STATA software designing procedures that apply these rules to the data starting with the first four surveys to check the validity of the program before applying to the other surveys up to 2008. Then for each of the households, the status of the household from one survey to the next was identified.

1.4.2 Household classifications and analysis types

With the household as the unit of analysis, each household was classified by its household member characteristics (the household composition) and family relationships (the family structure). A cross-sectional analysis was undertaken to show the distribution of the households by their structure (that is composition and family structure). This was followed by a longitudinal analysis to observe the patterns of household survival (whether the household dissolved or migrated) and household structural changes over time; and to investigate whether these patterns alter when adult HIV infection or adult mortality experience in the household is taken into consideration.

1.4.3 Follow-up periods for longitudinal analysis

In the longitudinal analysis, two durations of follow-up are used: the 'short-term' which is an observation over a one-year follow-up period and the 'long-term' which is an observation over four to five year follow-up periods. As described in Table 3, the annual follow-ups over the 19 surveys totalled to 18 annual follow-up periods. To generate the long-term follow-up periods, the surveys are first split between the years before and after the new villages were introduced which was survey period 1999/2000. This creates 10 annual follow-up periods before this point and 8 annual follow-up periods after this point. To evenly distribute the long-term follow-up periods, the long-term periods before 1999/2000 are split into five year follow-up periods (1989-1995 and 1995-2000) and after 1999/2000 into four year follow-up periods (2000-2004 and 2004-2008).

The split in the follow-up ensures that observation time is not too short to observe the household response (thus the choice of a follow-up of at leastone year) and not too long for the natural cycle or other effects to bias the outcomes (thus the cut-off long-term follow-up period set at five years). The description of these follow-up periods in Table 3 not only shows the follow-up periods but the baseline survey periods as well.

1.4.3.1 Survey periods versus follow-up periods

It is important to differentiate between the two terms 'survey period' and 'follow-up period'. The thesis covers 19 GPC surveillance surveys between 1989 and 2008; these are referred to as 'survey periods' in this thesis. The longitudinal analysis involves following households between the survey periods over a short-term follow-up period (SFP) or long-term follow-up period (LFP) with the thesis covering 18 SFPs and 4 LFPs (described in Table 3).

Table 3: Description of short-term and long-term follow-up periods

Survey period	Annual follow-up period (short-term)			4 or 5 year follow-up period (long-term)		
	Follow-up period (FP)	Baseline survey period	Short follow-up period (SFP)	Follow-up period (FP)	Baseline survey period	Long follow-up period (LFP)
1989/1990						
1990/1991	1	1989/90	1989/90 - 1990/91	1	1989/90	1989/90 - 1994/95 (1989 - 1995)
1991/1992	2	1990/91	1990/91 - 1991/92			
1992/1993	3	1991/92	1991/92 - 1992/93			
1993/1994	4	1992/93	1992/93 - 1993/94			
1994/1995	5	1993/94	1993/94 - 1994/95			
1995/1996	6	1994/95	1994/95 - 1995/96	2	1994/95	1994/95 - 1999/2000 (1995 - 2000)
1996/1997	7	1995/96	1995/96 - 1996/97			
1997/1998	8	1996/97	1996/97 - 1997/98			
1998/1999	9	1997/98	1997/98 - 1998/99			
1999/2000	10	1998/99	1998/99 - 1999/2000			
2000/2001	11	1999/2000	1999/2000 - 2000/01	3	1999/2000	1999/2000 - 2003/04 (2000 - 2004)
2001/2002	12	2000/01	2000/01 - 2001/02			
2002/2003	13	2001/02	2001/02 - 2002/03			
2003/2004	14	2002/03	2002/03 - 2003/04			
2004/2005	15	2003/04	2003/04 - 2004/05	4	2003/04	2003/04 - 2007/08 (2004 - 2008)
2005/2006	16	2004/05	2004/05 - 2005/06			
2006/2007	17	2005/06	2005/06 - 2006/07			
2007/2008	18	2006/07	2006/07 - 2007/08			

1.4.4 The new villages in the analysis

As pointed out in the description of the GPC, the study started with 15 villages then an additional 10 villages (new villages) were included in 1999 increasing the number of households in the study. However this led to the re-inclusion of households that were previously in the old villages and migrated to the new villages before the inclusion of the new villages. Having no effect on the cross-sectional analysis (where comparisons are made within and not across the study periods), a bias in the longitudinal analysis could exist. This is because these households would have been considered as previously migrated households with a gap of missing data between when they migrated and when the new villages were introduced. Due to this, these households are thus not included in the longitudinal analysis.

1.4.5 Longitudinal investigation of household survival

The key measures of household survival being considered are household dissolution, where a household ceases to exist; and household migration, where a household relocates within or outside the GPC study area. More on the definition and description of household dissolution and migration is provided in Chapter 2. The levels of dissolution and migration are measured separately using rates and rate ratios generated in STATA by a parametric survival model that assumes an exponential survival distribution (assuming a constant hazard). The models also allow for the recurrence of the migration outcomes as a household may migrate outside the study area, return and migrate again in the same follow-up period. Only households existing in the specific baseline survey period are followed for the respective follow-up periods taking into consideration their composition and family structure at baseline. Households not in the study at baseline but return or are newly created during the follow-up period are included in the next follow-up period only if they are still in the study at that baseline. With the short-term analysis having 18 baselines and the long-term only 4 baselines (Table 3), the long-term analysis will cover fewer households relative to the short-term analysis.

In the longitudinal analysis the household's baseline characteristics (household composition, family structure and socio-economic status) are considered as well as the household dissolution, household migration, adult household member HIV infection and mortality events observed during the follow-up period. In the investigation of household change, the changes in the household structure (household composition and family structural changes) are observed during the follow-up periods. The key research questions to be answered by this study are:

1. What are the overall levels of household dissolution and migration, and how do these vary by survey (in Chapter 2), baseline household structure (in chapters 3 and 4) and events of adult HIV infection and mortality in the household? (in Chapter 5)
2. Among households that "survive" (do not migrate or dissolve), how does household structure evolve over a period of four to five years? (in chapters 3 and 4)

3. What is the effect of adult HIV infection on household survival and when is this effect most felt? (in Chapter 5)
4. Does this effect depend on the sex and position in the household of the HIV-positive adult(s)? (in Chapter 5)
5. What is the effect of adult death on household structure, among "surviving" households? (in Chapter 5)
6. Does this depend on the cause of death (HIV or non-HIV), sex, and position in the household of the adult who died? (in Chapter 5)

These questions will be broken down in more detail in the specific chapters that follow including the hypotheses to be tested and a conceptual framework that illustrates these hypotheses even further (in chapters 3, 4 and 5).

2 IDENTIFYING A HOUSEHOLD AND TRACING HOUSEHOLDS OVER TIME

2.1 Introduction

This thesis and research study uses the household as the main unit of analysis making the identification of a household an important aspect of this study. This chapter presents an overview of household and household head definitions. These definitions are used to identify techniques to trace households over time. These techniques are then applied to the GPC data tracing households over 19 survey periods. Whether the household 'survived' (that is remained in the same location, or relocated within the study area) or not (dissolved or relocated outside the study area- referred to as migration in this thesis) is identified between the follow-up periods. More on the description of household survival is illustrated during the description of the household tracing procedure. Finally, the percentage of survival and the rates of non-survival (rates of dissolution and the rates of migration) are then generated as examples of what can be achieved with households traced over time.

With the GPC households traced over 19 years, the following research questions are also addressed in this chapter:

- What are the percentages of household survival over 4 to 5 years of follow-up?
- What are the rates of household non-survival?
    - Do these rates differ by village location (old or new villages)?
    - Do these rates differ by the follow-up period

As mentioned in Chapter 1, ART was offered to eligible participants in the GPC study area under a study known as the Rural Clinical Cohort (RCC) since January 2004. It would be of interest to know whether this has had any overall impact on the reduction of household non-survival. Seeley (2013) also reports drought experienced in the villages in the study setting in 1992 resulted in low agricultural yields and food shortages and prolonged dry spells in 2004. It would be of interest to know whether an increase in household non-survival was observed during this time as the household residents relocated better areas. In addition, as

described in Chapter 1, the villages in the GPC study are distinguished between the old and new villages with the main trading centre located in the new villages and the findings by Mbulaiteye (2002) showing that villages around the trading centres are characterised by an increased trading activity and individual mobility. It would therefore be of interest to know whether the rates of non-survival are higher in the new villages. To answer these specific questions, the following hypotheses are of interest:

1. There is a reduction in household non-survival after 2004
2. Household non-survival is highest the years close to 1992 and 2004
3. Household non-survival is higher among the new villages than in the old villages

2.2 Identifying a household

Although Niehof (2004) calls the 'household' a problematic concept, it is one of the commonest units used to obtain information about African families (Goody, 1989) and a building block for data collection and subsequent analyses (Bolt and Bird, 2003). However, the term 'household' is understood differently across disciplines and in different contexts based on the specific needs and constraints of the research being undertaken. Its description frequently overlaps and intersects with that of the family despite these concepts being distinctly different.

The meanings of the concepts of 'family' and 'household' have been long and extensively studied and debated. Most social scientists conceptualise family and household as separate but related entities. However, depending on the area of research, researchers may prioritise one over the other (van de Walle, 2006). In the working characterisations of the review on changes in family and household demography as a consequence of HIV and AIDS, Hosegood (2008) states that studies of the demographic impact of HIV/AIDS generally consider the household rather than the family unit. This is partly because households are far simpler than families to identify and document in large surveys and censuses. Furthermore, the household as an economic and productive unit is of great interest to researchers investigating the socio-economic consequences (income, expenditure, labour and assets). These consequences include morbidity, mortality and the transmission of infections with a household referred to as society's most commonplace and basic socioeconomic unit. More specifically, since the

early 1990s, HIV related investigations in south-western Uganda (study area of the thesis) or Uganda as a whole commonly have used a household as the unit of investigation for example research by Janet Seeley in south-western Uganda (Seeley et al., 1994, Seeley et al., 1995, Seeley et al., 2008) and those by James Ntozi covering a larger part of Uganda (Ntozi, 1997, Ntozi and Zirimenya, 1999).

Anthropologists and researchers define households in reference to the study being undertaken. Examples of these definitions are presented in Table 4 which shows examples of definitions used in studies in rural sub-Saharan Africa (for example Malawi, South Africa, Tanzania and, Zimbabwe), United Nations or World Bank manuals on censuses or surveys, and in discussions, comparative studies and reviews involving households. The common elements in these definitions refer to the household as a co-residential unit that is usually family-based and is characterised by collective provision of the essentials (food, shelter), geographical proximity, sharing of activities (such as food production); and acknowledging of one person as the household head. Moreover, the definition of households used by Chirwa et al. (2004) in northern Malawi and Kleppe and Gronhaug (1998) referencing the enumerators manual of the 1992/93 survey in Zambia state that the household member relationships do not necessarily depend on familial relationships. However a family can consist of numerous households.

Table 4: Defining a household

Year	Researcher	Study definition of the household	About the source of definition
1967	Bender	A set of individuals who share the same residence or live in close geographical proximity (Bender, 1967).	Discussing the concept of a household and family
1973	United Nations	A reflection of the living arrangements of persons, individually or in groups, for providing themselves with food, shelter and other essentials (United Nations, 1973).	United Nations manual aid to demographers and population experts to project households and families using data from population and housing censuses
1975	Berkner	Co-residence under the same roof is not crucial; of more importance is whether the household members cook and eat together and the nature of their social and economic relations (Berkner, 1975).	Comparative study on the history of a household or family in England, France, Serbia, Japan, Colonial North America and Western Europe
1979	Yanagisako	A set of individuals who share not only a living space but also some activities such as food production, food consumption and child bearing (Yanagisako, 1979).	Anthropological discussion on the household and family
1987 1997	Ponnighaus et al. and Fine et.al	A group of people living together and acknowledging one person as a head (Ponnighaus et al., 1987, Fine et al., 1997).	Households in a study in Karonga district in rural Northern Malawi
1994	de Vries	Unit of co-residence and reproduction, of production and labour power, of consumption and distribution among its members, and of transmission across generations (de Vries, 1994)	In the discussion of the British industrial revolution and the industrious revolution as a household-level change
1995	Rudie	A co-residential unit, usually family-based in some way, which takes care of resource management and primary needs of its members (Rudie, 1995).	A study of Malay households in various villages in Kelantan
2000, 2003	Budlender	A person or a group of persons who: eat together and share resources; normally resides at least four nights a week; and have a household head who is acknowledged by the other	Budlender queries the use of the term and concept of household head in censuses and surveys

		members and who is also a member of the household (with a live-in domestic worker considered to belong to a separate household)(Budlender, 2003) .	
2001	Urassa et.al and Schellenberg et.al	A group of people who regularly eat from the same pot (Urassa et al., 2001, Schellenberg et al., 2008).	Demographic surveillance and verbal autopsies of households in rural north-west Tanzania to assess the impact of the AIDS epidemic on mortality and household mobility before and after death.
2006	Timæus	Residential groups (that need not comprise family) defined using one or more of the following criteria: co-residence in the same dwelling; commensality (eating together); pooling resources together; and the acknowledgement of authority as an identified household head. One or more persons who share a dwelling and make common provision for food and other essentials for living. (Timæus, 2006b)	ALPHA-Network Workshop 2 – Family demography. Using data from Karonga (Malawi), Hlabisa (Kwazulu-Natal, South Africa) and Manicaland (Eastern Zimbabwe)
2007	Wittenberg and Collinson	An individual qualifies as a member of a household if he/she spends an average of four nights per week in the household (Wittenberg and Collinson, 2007).	The investigation of changes in household structure in rural north eastern South Africa over the period 1996–2003
2008	Hosegood	Characterised by their shared economic basis; the household members' recognition of a single household head, and a single place as primary residence (for some or all of the members) (Hosegood, 2008).	Working characterisations used in the review that examines the evidence for changes in family and household demography as a consequence of HIV and AIDS in sub-Saharan Africa
2012	World Bank	A group of persons who: live, cook and eat together; share a common source of food and/or income; have one person who they regard as the household head. Or a single person who lives alone and eats independently (World Bank, 2011).	Household definition in the Uganda manual of Instructions to field workers in the 1992 survey

2.2.1 Who is the household head?

Researchers and authors seem to also include the identification of the household head in the definition of the household. In the discussion on the concept of the household head, Budlender (2003) provides two major purposes of identifying a household head: to determine a household, and as a household classifier by relating the other household members to the household head. In the 1973 UN review of national population censuses (United Nations, 1973), the suggestion was to take the oldest adult resident male as the head, or, in the absence of an adult male, the oldest adult female. According to Budlender (2003), the term 'head of household' is used to cover several different concepts including the chief economic provider, the chief decision maker, the person designated by other members as the head and many more. The focus changes depending on the specific circumstances of the country or society. Generally, the definition of head of household reflects the stereotype of the man in the household as the person in authority and the bread winner. Budlender (2003) gives further determinants of the household head as:

a) Self-definition: the person who nominates himself or herself as the head, or who is designated by other household members;
b) Identification of the person in authority: that is the person who controls the maintenance of the household and exercises the authority to run the household;
c) Identification of the economic supporter of the household: that is the chief earner or the main supporter of the household's economy.
d) The 'householder': the person in whose name the dwelling is rented or owned (used commonly in developed countries).
e) Presence of adult men: according to many definitions a woman-headed household is one without adult men, while a man-headed household may contain adult women (for example in the comparison of the definitions of female-headed households in the Dominican Republic by Rogers (1995))

2.2.2 Definition of a household and household head in the General Population Cohort

In 1989, GPC (the data source for this thesis) decided that a household was to be defined as a group of individuals who regularly eat from the same 'pot' of food and either live together or live in close proximity to the main residence. To qualify as a member, a person must have been resident in a household for at least three months or be intending to stay for more than three months. Household membership is determined by the member or members of the household interviewed by the 'mapper' when compiling the initial list of household members. These may be family members who are related through kinship or marriage or non-family members such as tenants and domestic workers. The household does not include family members who do not live in the same structure or compound and do not share food and other resources, but this is often difficult to determine when they live in the same village or pay frequent visits. This definition is intended to allow some flexibility to accommodate the fact that a household member may be resident in one building (hut or house), several buildings in a common yard or in neighbouring buildings.

The mapper and later the census team describe the household head as one who makes the major decisions for the household and from this description, the household members are then asked to identify who of the household members is the head. This means that for one to be the household head, he/she should be a household member. In the case where the household members claim the household head is not resident, then they are asked to name the resident household member who is undertaking the roles of the head in his/her absence and it is this individual that is considered as the head

Also accommodated are household heads with more than one spouse residing either in the same building or in neighbouring buildings but regularly eating from the same 'pot' as one household. If the spouses do not eat from the same 'pot', their households are considered separate. However, although a man with multiple partners may not be a permanent resident in more than one of his wives' households, in most of these cases the mapper lists him as the household head in each of the homes. This also means that an individual can be listed as a

household member in more than one household. It is common that for a married couple, the household head is the man. However there are instances where the married woman is the head especially if the woman is receiving little or no support from the man.

Furthermore, the identification of the household head depends on who is asked, for example a man claiming to be the household head in one survey and in the next survey the spouse claiming she is the household head when asked in the absence of the husband. Although the household is identified as the same household, this affects the classification of headship by sex.

2.2.3 Cultural characteristics of a household in the GPC study setting

Over 74% of the GPC population are ethnically Baganda among which (like in most ethnic groups in Uganda) a household is mainly formed through marriage. After a marriage, the woman is much more likely than the man to move to a new location, with the man assuming headship. The ideal is the new household being established after marriage, which consists of ritualised negotiations and a transfer of bride-wealth at a feast known as an `introduction' (*Kwanjula*) (Karlström, 2004). These traditional ceremonies are sometimes followed by a religious or civil wedding.

However, cohabiting is very common among the Baganda with or without verbal or written parental-permission or in preparation of marriage in the future. The high cost of the marriage ceremonies and bride-wealth is one of the main reasons for not formalising a partnership. The information compiled by the GPC does not differentiate between household members who are cohabiting, those in a traditional marriage, and those in a religious marriage. All of these are considered as married as long as the respondent acknowledges the marriage.

Polygamy persists among the Baganda, as in other parts of Uganda. The 2006 Uganda Demographic and Health Survey (Uganda Bureau of Statistics, 2006) found that over a quarter of marriages in Uganda are polygamous. Occasionally the wives share a compound, but in most polygamous marriages, the women live separately, with the man moving from household to household (Seeley, 2012).

Marital instability resulting in the separation of the couple is common especially when there is no marriage contract. When this happens a woman may move to stay with her parents or a brother, taking some or all of the children with her. The man may remain with older children (because they belong to his clan) or ask a relative (often his mother) to care for them, while the younger children may go with the mother and return to live with the father when they are older (most especially the boys). Separation may thus result in single adult households or complex household structures with adult residents, at least for a time.

Finally, a man/husband is commonly recognised as the household head irrespective of whether the financial provision and decision making are done by another household member for example the female spouse or an adult child. The adult child commonly takes up the decision making and support if the household head is very old or ill.

2.3 Tracing households

2.3.1 Why trace households

Households change over time as a consequence of births, deaths and movement. These household dynamics play a crucial role in determining social and demographic patterns and patterns of disease in the population. The household change includes among others, the change in the household's structure, household dissolution or household movement (in-migration or out-migration). Although there is a considerable literature on households in both developed and developing countries, much of this relates to cross-sectional studies of household size and composition, with very few studies investigating changes over time (Chirwa et al., 2004). The identification of household changes has become of great interest as researchers look at the impact of HIV on households and communities as a whole. The availability of longitudinal information collected annually by the GPC provides an opportunity to investigate these changes. However the GPC, like many other demographic health studies, tracks individuals instead of households over time. Household information is gathered at a point in time with the household identification changing if the household changed location. This kind of household information data has several limitations such as the uncertainty of the status of a household after migration within or outside the study area,

a situation also reported by researchers such as Urassa et al. (2001) in rural Tanzania. It can sometimes be unclear whether a household is the 'same'household the second time it is seen, especially if its composition has changed or there is a new head.

Therefore to track households over time, they need to be retrospectively traced from one study point to the next assigning each household a unique identification. This will enable observation of the changes experienced by the households over time.

2.3.2 How have households been traced

Despite the need for this retrospective tracing of households, it has received little attention in the literature. Relatively few researchers have applied detailed criteria of tracing households over time, particularly in an epidemiological cohort. Key examples from sub-Saharan Africa include: investigation of changes in household structure in rural South Africa in 1996–2003 (Wittenberg and Collinson, 2007); investigation of the impact of adult mortality on household dissolution and migration also in rural South Africa in 2000-2002 (Hosegood et al., 2004a); and a study of household dynamics in northern Malawi in the 1980s (Chirwa et al., 2004).

More on the tracing exercises undertaken in these studies is summarised in the next subsections. However one of the strictest household tracing definitions reported identifies a particular household as the same household on the second visit, if the same group of people are living together in the same place, with the same relationships to each other as the first time the household was seen. Yet in reality, households are constantly changing as people enter and leave them through birth, death or movement (Chirwa et al., 2004). Another definition identifies the household as the same if the household head in both visits is the same. This means that the household is not identified as the same if the head has died or left (Chirwa et al., 2004), although this may not be the case if a spouse or adult child of the head has subsequently taken up the headship.

2.3.2.1 Impact of adult mortality on household dissolution and migration in rural South Africa

The Africa Centre Demographic Information System (ACDIS) conducted a demographic surveillance of the population in a rural area in northern Kwazulu-Natal, South Africa, between January 2000 and October 2002 (Hosegood et al., 2004a). The main objective was to investigate the impact of adult death on household dissolution and migration. In this study, a household could only have one place of residence in the demographic surveillance area (DSA) at any given time. A household was said to have migrated if it moved/relocated as a social group to another place within or outside the DSA. A household could 'migrate' within the DSA (internal migration); to a place outside the DSA (out-migration); or from a place outside the DSA (in-migration). However, routine surveillance of a household ended if it migrated out of the DSA. This was differentiated from dissolution where a household as a social structure ceased to exist for example a surviving partner joining one of her children's household after the death of her husband.

2.3.2.2 Changes in household structure in rural South Africa over the period 1996-2003

The main objective of this study was to investigate changes in household structure in rural South Africa from 1996 to 2003, a period marked by politico-structural change and an escalating HIV/AIDS epidemic (Wittenberg and Collinson, 2007). The study relied on secondary information from two sources: national household surveys by Statistics South Africa; and the Agincourt demographic surveillance system (DSS) collecting health and demographic surveillance data (a source similar to that used in section 2.3.2.1). In this study, a household was identified as a continuing household between visits (November 30th of each year) if it was recorded in the same dwelling showing an overlap of at least one member. Newly-formed households and those that appeared for the first time in the database as a result of in-migration were also identified. Also identified were those that disappeared due to out-migration or dissolution.

2.3.2.3 Household dynamics in Northern Malawi during the 1980s

This study was undertaken as part of an epidemiological study of leprosy and tuberculosis with the major aim of providing an unusual insight into the structure and dynamics of households in a rural sub-Saharan African population during the 1980s (Chirwa et al., 2004). A total of 112,026 individuals belonging to 17,889 households in Karonga District, northern Malawi, were interviewed and examined in the early 1980s and followed up over five years. Because of the scale and complexity of the different circumstances that arose while tracing households, rather than attempting to formulate a complete set of fixed rules, the interviewers were left to judge whether a household in the study was the 'same' over time and their decisions were reviewed by the coding manager according to a set of general guidelines. This was possible because the tracing was done prospectively by the interviewers during the data collection. The general guidelines defined a household as the same if:

- the household head remained the same in the same location, or
- the original head had died but most of the members remained in the same location, the headship having been inherited by someone else (for example the wife, child or parent of the deceased), or
- the original head had left, but most of the members remained together in the same location, the headship having been assumed by, for example, the divorced ex-wife, or
- the original household had been headed by a wife while the husband was away, but he had since returned home and assumed the headship, or
- the original household had just moved from one location to another with the head and most of the members still together.

Like the studies in rural South Africa, a household could migrate within the study area (internal migration); to a place outside the study area (out-migration); or from a place outside the study area (in-migration), thus forming a new household. In addition new households in Malawi, as elsewhere, were formed through marriage with the woman being more likely than the man to move, and the man to assume the headship, except in a few matrilineal cultures in southern Malawi where one belongs to the mother's lineage (Mtika

and Doctor, 2002). In addition, due to the polygamous nature of some societies, a man could be the head of more than one household.

Hosegood (2008) also highlights the fact that many longitudinal household studies do not distinguish between household dissolution (household as a recognised social group ceasing to exist) and household migration (as the social group remaining intact but together relocating elsewhere), especially where a household migrates outside the designated study area. This is mainly because the main interest of most of these studies is to observe processes that signal the rearrangement in the domestic arrangement of households whether it is through the surviving household members going to join other households (process that signals household dissolution) or the physical relocation of the household's residence (household migration). However, it would be of interest to be able to differentiate these household events of dissolution and migration to observe whether the 'reasons' (for example, HIV infection, mortality, famine/drought) of these events differ, which events are related to particular 'reasons' and comparison of the purposes in studies that look at these events separately.

2.3.3 Tracing households between visits across two points in time

Rich in relational information on the household residents, the GPC provides an opportunity to construct a set of rules for retrospectively tracing households over time. As seen in the examples above, the researchers above provide two distinct techniques: following the household head and considering where majority of the household members are resident. I choose to follow the principal household member as the major determinant of the household's existence. As mentioned in Chapter 1, the mapping exercise of the GPC households includes the identification of the household head, who is the person acknowledged by the other household members or the mapping team as the household head.

Table 5: Tracing of households over two time points

Household head status between two time points		Household status
Same household head		
	In the same geographical location	Same household
	In a different geographical location	Same (relocated)
Divorce between household head and spouse		
	Household head and spouse maintain co-residency	Same household
	Household headed by the divorced household head	Same household
	Household headed by the divorced spouse	New household
Death of the household head		
	Next-in-line[1] takes over headship	Same household
	Majority of the household head's children remain resident	Same household
	No next-in-line[1] takes over headship	Dissolved
Loses household head status		
	Another takes up headship of the household	Dissolved
	Relocates to another household and doesn't retain headship (for-example household head returns to parental home)	Dissolved
	The headship is interchanged between a husband and wife but both are resident	Same household
Household head moves/relocates outside study area		Out-migrated
	Household formed by the residents that remain in the residence	New household
Household head moves to an unknown location		Lost to follow-up
	Household formed by the residents that remain in the residence	New household
Re-identified after a previous out-migration or loss to follow-up		Left and returned
Newly created households		
	Product of an individual shifting from another household where he/she was not a household head	
	Household head creating another household	
	Product of in-migration (from outside the study area)	
	Missed in previous time point	
	By a person who was once a household head of a previously dissolved household[2]	

[1] Next-in-line determined by the hierarchy of the close relations to the household head (that is, the spouse, biological child, parent, or sibling)

[2] Once dissolution occurs, a household cannot be re-created. If the household head of a previously dissolved household forms a household in the study, it is considered as a new household

Between two visits, a household can therefore: continue in the same or a different location within the study area; relocate outside the study area (classed out-migrated); relocate to an unknown location or refuse to participate (collectively referred to as lost to follow-up, as these cannot be differentiated from the data); cease to exist (dissolved); or return to the study area after an out-migration (left and returned). In addition new households can be created. The principles established to trace these changes across the annual GPC surveys are summarised in Table 5. This table shows the main determinant of household continuation being the existence of the household head at both visits. There is, however, a diversion from this rule when the household head dies and the continuation of the household is determined by the headship being taken up by the 'next in line' or a majority of the deceased's children remaining resident in the household. Another diversion was described at the end of section 2.2.2 where there are cases where the headship is interchanged between the husband and wife. For as long as both were resident, irrespective of who was the household head, the household was considered as the same.

2.4 Application of the tracing criteria to the GPC household data

2.4.1 Tracing GPC households

With the retrospective household tracing based on primarily following the household head, (as shown in the criteria described in TABLE 5), information on relationship of the household members to the household head is also crucial. The GPC collects relational information of the household residents and unlike most demographic and health surveys, not all the residents are related to the household head. Instead, the residents are related to the household member to whom they are most closely related thus providing even more relational information. For example, children are coded with reference to their mother if resident;

while a married woman is coded with reference to her husband. To retrospectively trace households with reference to the household head, all the household residents have to be related to him or her. Examples of some of the relational recoding are shown in the Appendix 8.1. However, the restructuring of the relationship codes leads to some loss of relational information.

The application of the retrospective household tracing criteria summarised in Table 5 to the households listed in the GPC between 1989 and 2008 not only identifies a household but also categorises whether the household 'survived' (in the same location or relocated within the study area, considered as survived because the GPC has knowledge on the household), dissolved or out-migrated, was newly created, or returned to the study area after an earlier out-migration. Therefore with this categorisation, a surviving and non-surviving household can be identified. The households which relocated within the study area are considered as surviving households along with those that remained in the same location; while households that dissolve or out-migrate are considered as non-surviving households. In addition, some households are observed in one point but not located or identified in the next with no reason provided. These are referred to as lost to follow-up and are not included in the analyses.

2.4.2 Findings from the tracing of households

Overall, a total of 7,875 households were found to have participated in the GPC between 1989 and 2008. Of these, 5,413 (68.7%) were first observed in the old villages, 2,434 (30.9%) in the new villages (villages included in the GPC in 1999/2000) and 28 (0.4%) households first located in the old villages but relocated to the new villages before the inclusion of the new villages and identified again after the inclusion of the new villages. Further, the distribution of the number of households in each GPC surveys (presented in Table 6) shows an average of 2,016 households in the earlier survey periods and 3,494 in the later survey periods after the geographical survey area was widened.

Table 6: Number of households by survey period

Early survey periods	Number of households	Later survey periods	Number of households
1989/90	1,894	1999/2000	3,433
1990/91	1,966	2000/01	3,548
1991/92	2,045	2001/02	3,492
1992/93	2,001	2002/03	3,503
1993/94	2,019	2003/04	3,489
1994/95	1,971	2004/05	3,454
1995/96	1,988	2005/06	3,422
1996/97	2,011	2006/07	3,478
1997/98	2,111	2007/08	3,629
1998/99	2,152		

Tracing of households described also enables one to follow households over one of more FPs. Therefore, using the long-term FPs (LFPs) described in the introduction (Section 1.4.3, Table 3), the results of the household tracing over the LFPs are summarised in Table 7.

Those present at the end of the FP are those that:

- existed from the start to the end of the FP
- temporarily out-migrate or were lost to follow-up after the start of the FP but returned within the FP
- were newly created after the start of the FP and existed to the end of the FP
- out-migrated or were lost to follow-up in a previous FP and returned in the FP under consideration.

Those not present at the end of the FP are those that:

- out-migrated after the start of the FP and did not return during the FP
- were lost to follow-up after the start of the FP and did not return during the FP
- dissolved after the start of the FP
- were newly created after the start of the FP but do not continue to the end of the FP.

As noted in the description of the study setting (section 1.2), additional villages were added to the GPC in the survey period 1999/2000. This accounts for the increase in the number of households for the results corresponding to the 2003/2004 and 2007/2008 survey periods; and an increased number of newly-created households between 1998/1999 and 2003/2004 survey periods.

Not including the aspect of the location of households in the old or new villages, but considering a household in reference to the number of households at the start of the FP (that is considering only the households at the start of each of the FPs) and averaging over the four FPs:

- Of the households identified at the start of each of the FPs:
    - surviving households:
        - 69.1% existed from the start to the end of the FP
        - 3.9% temporarily out-migrate or are lost to follow-up after the start of the FP return during the same FP
    - non-surviving households:
        - 15% out-migrate after the start of the FP and do not return during that FP
        - 8.1% dissolve after the start of the FP
    - Lost to follow-up:
        - 3.8% are lost to follow-up after the start of the FP and do not return during that FP
- Of those not identified at the start of the FP but identified at the end of the FP (percentages in reference to the number of households at the start of the respective FP):
    - 32% are newly created after the start of the FP and remain existent in the study to the end of that FP
    - 2.3% out-migrated or were lost to follow-up in previous FPs and return in the FP under consideration
- And, 14.8% are newly created after the start of the FP but do not remain in the study to the end of that FP.

However, as stated above, 28 households left the survey in the early survey periods in the old villages and were identified as 'returning households' in the later survey periods as part of the new villages. These are included in the returning households between 1998/1999 and 2003/2004 (among the 71 returning households) or between 2003/2004 and 2007/2008 (among the 136 returning households). However as stated in section 1.4.4, these 28 households are excluded in the further longitudinal analysis generating household non-survival rates (rates of dissolution and rates of migration).

In this further longitudinal analysis, households identified at the start of each of the FPs (baseline) are followed over the short-term (one year) and long-term (four to five year) to generate the dissolution and migration (relocation outside the study area) rates. A detailed description of the baseline survey period, SFPs and LFPs is given in section 1.4.3 in Table 3.

The results of following the study households at baseline for the SFPs and LFPs are shown in Figure 6 and Table 8 showing the dissolution and migration rates per 100 household years (HYRS) of households in the old or new villages at baseline. Figure 6 shows the migration rates approximately twice and three times the dissolution rates of the households in the old and new villages respectively. There is not much evidence of a difference between the dissolution rates in the old villages and the new villages with a rate ratio of 1.18 (p-value=0.05) in the short-term and 1.09 (p-value=0.356) in the long-term. There is, however, evidence of higher migration rates in the new villages than in the old villages with a rate ratio of 1.36 ($p<0.001$) in the short-term and 1.31 ($p<0.001$) in the long-term. There is no overall evidence of a difference in the rates across the FPs, however there are very high migration rates in the old villages in 1992-1995; and in 2003-2005 in the new villages highest at a rate of 9.3 per 100 HYRS.

Table 7: Results from the application of the household tracing criteria on the GPC households followed from 1989 to 2008

Survey periods			1989/90	1993/94	1998/1999	2003/04	2007/08
Number of households at the specific survey periods			1,894	2,019	2,152	3,489	3,629
Household survival during the 4-5 year follow-up period (FP)	**Survived**	Same location or change location [1]	1,334 (70.4%)	1,365 (67.7%)	1,471 (68.3%)	2442 (70.0%)	
		Leave (out-migrated/lost to follow-up) after the start of the FP but return before the end of the FP	75 (4.0%)	58 (2.9%)	73 (3.3%)	189 (5.4%)	
(Percentage relative to the start of the follow-up)	**Didn't survive**	Dissolve [3]	158 (8.3%)	175 (8.7%)	214 (9.9%)	197 (5.7%)	
		Out-migrate (do not return during the FP) [4]	264 (13.9%)	353 (17.5%)	306 (14.2%)	506 (14.5%)	
		Lost to follow-up (do not return during the FP) [5]	64 (3.4%)	67 (3.3%)	90 (4.2%)	156 (4.5%)	
Total of households at the start of the FP			1,894 (100%)	2,019 (100%)	2,153 (100%)	3,489 (100%)	
Newly created after the start of the FP and survive to the end of that FP (percentage relative to the number of households at the start of that FP) [6]			610 (32.2%)	687 (34.0%)	1874 (87.0%)[a]	862 (24.7%)	
Newly created after the start of the FP and **do not** survive to the end of that FP (percentage relative to the number of households at the start of that FP) [7]			295 (15.6%)	337 (16.7%)	935 (43.4%)[b]	379 (10.9%)	
Households that left a previous FPs and returned in the present FP (percentage relative to the number of households at the start of that FP) [8]			-	42 (2.1%)	71 (3.3%)	136 (3.9%)	

Household counts (using superscript numbers in the table):	Number of households at 'start' time point: 1+2+3+4+5; Number of households at 'end' time point: 1+2+6+8; Households not 'seen' at the 'start' and 'end' time points: 7
a:	After survey period 1998/1999, 1,874 households were newly created and continued to 2003/04. However 1,076 were in the new villages only included in the study in 1999/2000. Which means, **798 (37.1% in reference to the number of households seen in 1998/1999)** were newly created in the villages included in 1998/1999
b:	After 1998/1999, 935 households were newly created and do not continue to 2003/04. However 586 were in the new villages only included in the study in 1999/2000. Which means, **349 (16.2% in reference to the number households seen in 1998/1999)** were newly created in the villages included in 1998/1999

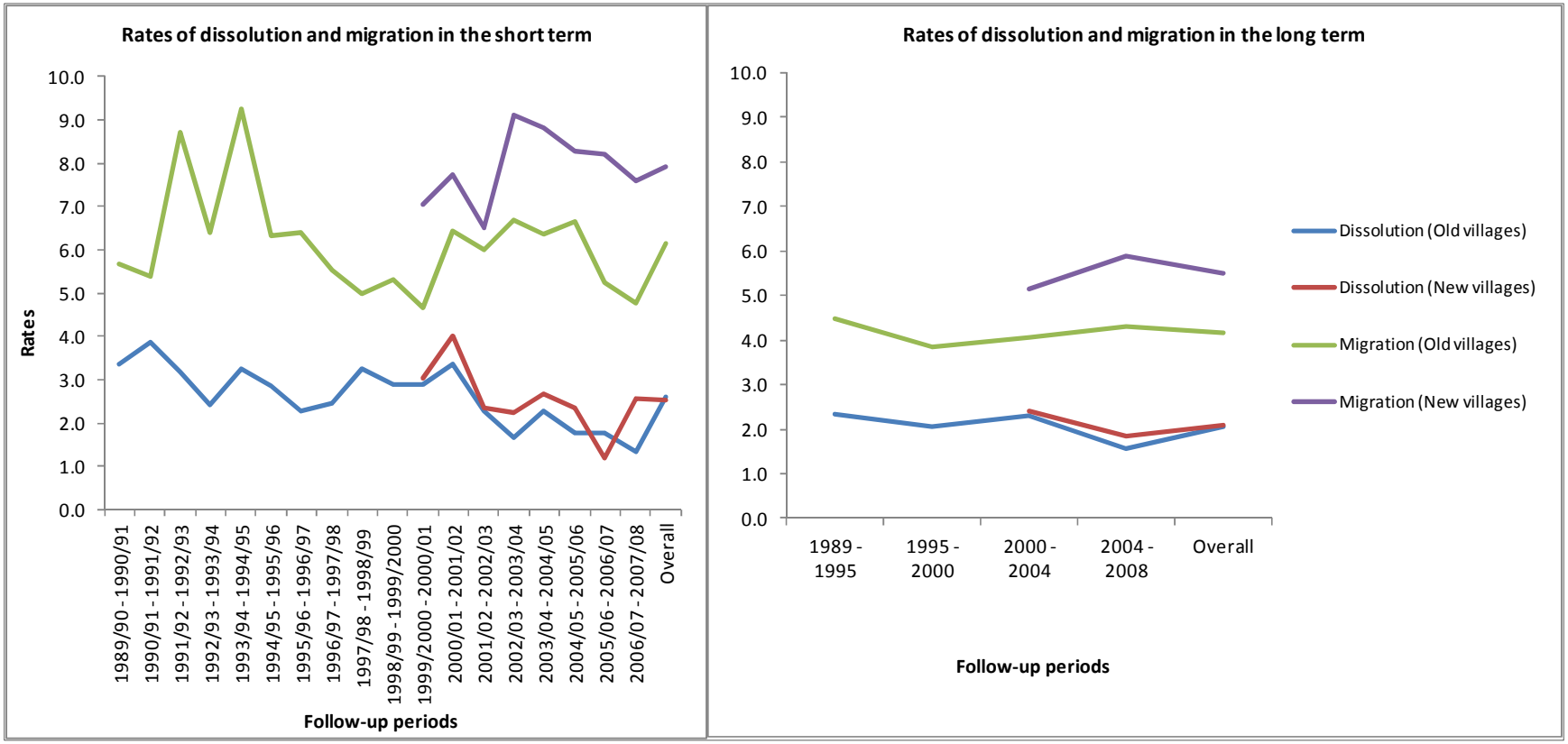

Figure 6: Distribution of dissolution and migration rates (per 100 household years - HYRS) by follow-up period and village location

Table 8: Rates (per 100 household years - HYRS) of dissolution and migration by village location

Per 100 HYRS:		All households	Households in the old villages						Households in the new villages					
Rates of:	In the:		Total	Dissolved /migrated	HYRS	Rates	95% C.I		Total	Dissolved/ migrated	HYRS	Rates	95% C.I	
							Lower	Upper					Lower	Upper
Dissolution	Short term	7,480	5,274	927	356.21	2.60	2.44	2.78	2,336	234	92.10	2.54	2.24	2.89
	Long term	5,406	3,803	644	311.87	2.06	1.91	2.23	1,631	169	80.28	2.11	1.81	2.45
Migration	Short term	7,480	5,274	2186	356.21	6.14	5.89	6.40	2,336	730	92.10	7.93	7.37	8.52
	Long term	5,406	3,803	1301	311.87	4.17	3.95	4.40	1,631	442	80.28	5.51	5.02	6.04

Comparison of rates in the Old and new villages

		Unadjusted rate ratio				Adjusting for the Follow-up period				
		Rate ratio	Lower	Upper	P-value[1]	Rate ratio	Lower	Upper	P-value[2]	P-value[3]
Dissolution	Short term	0.98	0.85	1.13	0.743	1.18	1.00	1.39	0.050	0.344
	Long term	1.02	0.86	1.21	0.824	1.09	0.91	1.32	0.356	0.555
Migration	Short term	1.29	1.19	1.40	< 0.001	1.36	1.23	1.49	< 0.001	0.507
	Long term	1.32	1.18	1.47	< 0.001	1.31	1.16	1.48	< 0.001	0.531

P-value[1]: comparing the rates of dissolution and migration of the households in the old and new villages

P-value[2]: comparing the rates of dissolution and migration of the households in the old and new villages adjusting for the follow-up period

P-value[3]: testing the effect of the follow-up period on the rates of dissolution and migration

.

Note that in Table 8, the number of households in the old and new villages does not add up to the number of the households under 'All households' and the number of households is less than the total number of households obtained at the tracing of households at the start of this section (a total of 7,847 households, 5,413 first seen in the old villages and 2,434 first seen in the new villages, and this does not include the 28 households that relocated to the new villages before inclusion). This is because, for the longitudinal analysis, considered are only the households in the study at the respective baselines that is 18 baselines (specifically not considering the households newly introduced in the 19th surveillance survey) in the short-term analysis and 4 baselines in the long-term analysis. It excluded the 28 households that relocated to the new villages before the inclusion of the villages. This thus totals to 7,480 households in the short-term and 5,406 households in the long-term analysis. The number of households is therefore lower in the long-term analysis because of the lower number of baselines or FPs.

In addition, with some of the households characterised by change in location, a household located in an old village at one baseline could relocate to the new village by the next baseline. This results in some households being included in both locations resulting in these households being included in the longitudinal analysis of both the old and new villages. This is therefore shown by the sum of the household numbers in the old and new villages being greater than the overall number of households used in the longitudinal analysis (that is: in the short-term analysis 5,274 + 2,336 = 7,610 > 7,480; and in the long-term analysis 3,803 + 1,631 = 5,434 > 5,406).

2.4.3 Response to hypotheses

Three hypotheses were stated at the start of this chapter (section 2.1). The first hypothesis predicted a reduction in household non-survival after 2004 that is after the introduction of free ART in the study setting. The investigation indeed shows the lowest percentage of household dissolution (5.7%) between survey periods 2003/2004 and 2007/2008 (Table 7) and the least dissolution rates after survey period 2004/2005 in the short-term and 2003/2004 in the long-term (Figure 6). A further split of the survey periods before and after

the introduction of ART (2004), shows evidence of the rates of dissolution (both in the short-term and long-term) higher before 2004 (as shown in Table 9).

Table 9: Comparison of dissolution rates (per 100 HYRS) and rate ratios before and after 2004 (when ART was introduced)

Type of analysis	Period before and after ART (Year 2004)	Rates of dissolution (per 100 HYRS)						Rate ratio in reference to before 2004			
		Number of households	Dissolved	HYRS	Rates	95% C.I		Rate ratio	95% C.I		p-value
						Lower	Upper		Lower	Upper	
Short term analysis	Before 2004	5,941	849	285.68	2.97	2.78	3.18	0.65	0.57	0.73	< 0.001
	During & After 2004	4,846	312	162.63	1.92	1.72	2.14				
Long term analysis	Before 2004	4,471	618	274.79	2.25	2.08	2.43	0.74	0.63	0.87	< 0.001
	During & After 2004	3,469	195	117.37	1.66	1.44	1.91				

The second hypothesis predicts non-survival of households in the 1992 and 2004 attributed to drought in 1992 and prolonged dry spells in 2004. Despite no overall evidence of a difference in the rates across the FPs, very high migration rates are indeed observed in the old villages between 1992 and 1995 and between 2003 and 2005 in the new villages.

The third hypothesis predicts household non-survival in the new villages attributed to the close proximity to trading centres characterised by individual mobility. Table 7 shows no significant difference between the dissolution rates in the old and new villages. However there is evidence that the migration rates are indeed higher in the new villages.

2.4.4 Separation of the old and new villages in analysis

The dissolution rates in the old and new villages show little difference; and though there is evidence of a difference in migration rates in the old and new villages, these rates increase or decrease in the same direction showing the 'same' outcome. I can therefore conclude that a separation of households by village location does not contribute much to the analysis and pulling all the households together would therefore be acceptable. Therefore in the chapters that follow, the longitudinal investigations will not be separated by village location; however adjustments will be made in the longitudinal analyses to adjust for any confounding.

2.4.5 Comparison of the findings with other studies

Household related studies, specifically demographic health studies, usually define households to suit the focus of the investigation being undertaken. This has led to different definitions of households in various studies and different household tracing criteria making the comparison of their findings difficult. However, attempts to compare the findings from the GPC data to those of the studies from rural South Africa and northern Malawi (described in Section 2.3.2) are shown below.

In the investigation of the impact of adult mortality on household dissolution and migration in rural South Africa between 2000 and 2002 (Hosegood et al., 2004a), the definition of a household is similar to that used in the GPC however the households are traced prospectively. In addition, the definitions of household migration and dissolution are similar. Hosegood et al. (2004a), reported that between January 2000 and October 2002, 2% of households in the study dissolved and 8% migrated out of the area; while 5.2% of the GPC households dissolved and 8.7% migrated during a 2-year follow-up between survey periods 1999/2000 and 2001/2002. The differences in household dynamics in these two studies may be attributed to the differences in the definitions and the differences in the rural South African and rural Ugandan settings.

In the 1980s study of household dynamics in northern Malawi (Chirwa et al., 2004), a setting which is broadly similar to rural Uganda, the continuation of the household was largely determined by most of the members remaining together while in tracing the GPC households it was determined by the status of the household head taking into account the relationship between the new and the previous household head. More than 84% of the households identified in the early 1980s and followed over 5 years in northern Malawi were recorded as the same household of which: 21% change location, 8% change headship, and 1% change both location and headship. The GPC shows an average of 73% of households at the start of a four to five year FP continuing to the end of the FP (including those that out-migrated or were lost to follow-up but returned in the study in the FP). The difference in the continuation may be partly explained by the 8% headship change in the Malawi study which was not seen as a newly-created household, as it sometimes was in the GPC. In other words, despite the

similarity between the Malawi and GPC study settings, the differences in the findings can be partly attributed to the methodological difference in definitions of household continuation.

2.5 Conclusion

While the concept of the household as a unit of analysis is widely contested, its usefulness in data collection and analysis cannot be disputed. Special care is needed not only with the definition of the household for a specific research aim, but also to ensure that this definition is adequately enforced during data collection, analysis and interpretation of the results. This chapter started with a description of the concept of a household relating this to what is used in the description of the GPC households. Using the household head as the household identifier, criteria to retrospectively trace households over time was developed and GPC households traced over 19 surveillance surveys identifying surviving (a household is in the same location between two time points or relocates within the study area) and non-surviving (a household ceases to exist or migrates outside the study area) households. However, the use of this procedure was mainly possible because the GPC household information not only uses a unique identification of the household members but also provides detailed information of their family relationships in the household and movement status (births, deaths, in-migration and out-migration).

Being able to follow households as a social group over time enables longitudinal analyses investigating the social dynamics in communities (for example, social mobility, changes in poverty levels and changes in household livelihood strategies) and the effect of HIV infection and adult mortality on the households or the communities as a whole. The simple investigation in this chapter has shown natural factors such as drought, dry spells and food shortages; household locality; and availability of free ART, as some of the determinants of household survival. Specifically drought, dry spells and food shortages increase the likelihood of a household's non-survival and the availability and use of ART increase the likelihood of household survival. This indirectly shows the possibility of an association between HIV infection and HIV related deaths to household survival (justifying this investigation in Chapter 5). In following chapters longitudinal investigations are undertaken

to determine whether a household's structure and/or experience of adult HIV infection or adult mortality has an impact on the household's survival or change in structure.

Even though tracing households prospectively has its advantages, the similarities in the GPC findings to those in studies designed to prospectively trace households shows that the retrospective approach illustrated in this thesis compares very well to the prospective approach.

3 DESCRIBING THE COMPOSITION OF HOUSEHOLDS

3.1 Introduction

With increasing interest in a better understanding of household dynamics, one way of investigating this is by observing the composition of households based on the characteristics of household members. This is achieved by investigating whether there is an association between a household's composition and its survival and also observing change of household composition over time. To accomplish this, longitudinal household studies are needed which are unfortunately very scarce. Also needed is the appropriate classification of the households by their composition.

Chapter 2 used the annual surveillance studies of individuals in their residences to determine and retrospectively trace households over 19 GPC annual surveillance surveys. The results provided a good description of household survival over time. The findings were also found to be similar to the few prospective longitudinal household studies conducted at other sites in sub-Saharan Africa justifying the use of retrospective household tracing as a viable option.

With longitudinal household information now established, this chapter focuses on appropriately classifying the households that participated in the GPC in south-Western Uganda between 1989 and 2008 by their household composition. This involves investigating whether there is any association between the household composition and household survival, and observing the patterns of change in household composition over time. The research questions specifically addressed in this chapter are:

- How can a household be described by its composition?
- What is the distribution of the GPC household by household composition?
- Is there an association between a household's composition and its dissolution and migration? If yes:
    - Which household composition types are most likely to dissolve or migrate?
    - Which household composition types are least likely to dissolve or migrate?

- How does household composition change over time?
- What could be the reasons for these household composition changes?

Based on the literature review on the description of household composition and the survival of households by their composition characteristics presented in sections 3.2 and 3.3, hypotheses and a conceptual frame are constructed and presented in section 3.4.

Working with the GPC data longitudinally restructured in Chapter 2, Section 3.5 shows the household composition broken down by household size, dependency ratio, age and sex distribution and the characteristics of household's head (sex and marital status). Section 3.6 relates these measures of household composition to the household dissolution and migration (the concepts of household dissolution and migration described in Chapter 2). Finally, section 3.7 describes the changes in household composition that occurred during the long-term follow-up periods (the follow-up concept is described in Chapter 1).

3.2 Household composition characteristics

The common household composition characteristics considered by researchers are the size of the household; age-sex distribution of household members; and characteristics of the household head, specifically the age, sex and marital status.

3.2.1 Household size and age-distribution of household members

The size of a household refers to its number of members (Hosegood, 2008, Hosegood and Timæus, 2006, Timæus, 2006b). This is sometimes broken down by the age-group of the household members (Falkingham and Klytchnikova, 2006); or into dependants and the productive household members.

A 'dependant' usually refers to a child aged under 15 (Falkingham and Klytchnikova, 2006, Madhavan et al., 2009) or an elderly person aged 50 or 60 years and over depending on the age distribution of the community being studied (Mather et al., 2004, Madhavan et al., 2009). In some studies, child dependants are split into the biological children of the household head

or spouse, and non-biological children of the household head or spouse (for example, grandchildren) with or without a parent resident in the household (Hosegood et al., 2004a).

Household members aged between 15 and either 49 or 59 years, depending on the community under study, are classed as productive members (Mather et al., 2004). Individuals in this age group are termed productive (or prime adults) because this is when an individual is most economically productive, and the age at which most reproduction, courtship and marriage events are registered (Mather et al., 2004, CHGA, 2011).

With the dependants and productive household members identified, some studies then compute the dependency ratio as another indicator of the household's composition (Madhavan et al., 2009). Commonly calculated as the ratio of dependants to productive household members, it simply shows how many household members are provided for by each productive member (Mather et al., 2004). The dependency ratio is also conventionally interpreted as the balance of those likely to be economically productive (with age as the proxy) in the denominator against those who depend on them financially in the numerator (Verdugo, 2006). However, in a country with a well-established state-funded non-contributory pension providing a steady monthly income, elderly people receiving a pension could be considered productive members of the household rather than dependants (Madhavan et al., 2009). This definition has been further refined to take into account the ability of productive adults to undertake their economic activity by classifying the productive adults as dependants, such that the dependency ratio is the ratio of the number of children and elderly and ill productive adults to the number of productive adults not known to be ill (Mather et al., 2004).

3.2.2 Age-sex distribution

In addition to describing household composition by the age of the household members, some studies also observe the sex distribution across the different age groups (age-sex distribution) (Timæus, 2006b). One study that has applied this way of classifying households is the ALPHA-Network, a network that brings together researchers working for demographic surveillance systems in southern and eastern Africa (ALPHA-Network, 2006).

In this type of household classification, each household member is categorised into 1 of 3 age groups: a child aged 14 years and under, young adult aged between 15 and 49 years, and an older adult aged 50 years and over. The ALPHA-Network used the age threshold for a child as 15 rather than 18 years because the median age of marriage for women was found to be around 18. The network wanted to ensure children were not mixed up in with the 15 to 17 year old women in early marriages. In addition, 50 rather than 60 years was used as the threshold for defining an older adult, for 3 reasons: first, the age structure at several of the Alpha-network sites was found to be young and the percentage of the total population aged 60 and over was low; second, most AIDS-related deaths occurred among individuals aged between 15 and 49 years; and third the 15 to 49 year age group was the most economically active group.

The ALPHA-Network then used this information to categorise all households according to whether they included members of one, two or all three of these age groups. Households with a young adult were further categorised according to whether they included at least:

i. a young male adult, but no young female adult
ii. a young female adult, but no young male adult
iii. a young male adult and a young female adult.

Then each household was categorised as a single-generation, two-generation, or three-generation household. The single generation household contained:

- all children ('child headed')
- young adults only, or
- older adults only.

A two-generation household was made up of:

- children + young adult female, no older adults
- children +young male adult, no older adults
- children +young adult female + young adult male, no older adults

- children + older adults ('skipped generation households'), or
- young adults and older adults, no children.

A three-generation household comprised:

- children + young adult female + older adults
- children + young adult male + older adults, or
- children + young adult female + young adult male + older adults.

3.2.3 Characteristics of the household head

Timæus (2006b) also uses the characteristics of the household head as another way of classifying the household, mostly identifying the sex, age and marital status characteristics (Chirwa et al., 2004). Various household composition categories have been developed from this classification including:

- female-headed and male-headed households (Foster et al., 1997, Urassa et al., 1997, Zulu and Sibanda, 2000, Nakiyingi et al., 2001, Chirwa et al., 2004, Hosegood, 2008);
- child-headed households with a household head aged under 15 years (Topouzis, 1999, Drimie, 2002, Heuveline, 2004, CHGA, 2011) or under 18 (Lyaga, 2011);
- elderly-headed households with a head aged 60 (Falkingham and Klytchnikova, 2006) or 50 years or over depending on the age distribution of the community being studied (Mather et al., 2004);
- a spouse of the household head living in the households, with the absence of a spouse usually used as an indicator of a single-parent household (Ankrah, 1993, Heuveline, 2004).

However, child-headed households are not included in several studies mainly because they are both rare and temporary, and have often been observed to be a result of errors in the data collection (Wittenberg and Collinson, 2007, Hosegood, 2008).

3.3 Household dynamics by household composition

Hareven (1978) emphasises the need to understand not only the current position of individuals and households, but also their changes over time (trajectories), arguing that this allows the understanding of the households. Timæus (2006c) describes household change through household dissolution, migration and structural change (including change in composition of the household). However, this kind of longitudinal research is rare mainly due to its high costs. Mostly available therefore is information from cross-sectional studies, although a few longitudinal studies have been undertaken. An example is a study by Ntozi and Zirimenya (1999) in Uganda investigating the changes in household composition and family structure (as a description of a household's structure) during the AIDS epidemic. This was a multi-phase study covering six districts in Uganda one of which includes the study setting of this thesis. With the same definition of a household with that used in the GPC, baseline household information is collected in mid-1992, late 1992 and early 1993 selecting households that experienced a death in the last ten years prior to the survey; and a follow-up in July and August 1995 including the additional households not included at baseline but experienced a death between the baseline and the follow-up periods. Information collected included the age, sex and marital status of the household members identifying the household head and the relationships of the household members to the household head; the orphans, widows, deaths and a cause of death specifically identifying AIDS related deaths. Ntozi and Zirimenya compared these household and household member characteristics between the years 1992 and 1995 to determine whether the AIDS epidemic had an effect on these characteristics. A comparison of the household head characteristics between 1992 and 1995 showed:

- a decrease in households headed by a woman (33.7% to 25.4%) and an increase in those headed by a man (66.3% to 74.6%);
- a slight increase in households headed by a married head (74% to 80.4%); with an increase in male heads that are married (90.1% to 94.5%) but a decrease in female heads that are married (42.2% to 39.4%)

- a very small proportion of child heads (aged less than 18 years) with a slight decrease (1.2% to 1%); a majority of heads middle-aged (aged between 18 and 60 years) showing decrease (75.7% to 72.2%); and an increase in older aged heads (23.1% to 26.8%)

With the increase in married heads corresponding to a reduction of separated/divorced, Ntozi and Zirimenya attribute this to:

- Some of the widows could have been inherited or remarried which is common in most African societies (Okeyo and Allen, 1994).
- The death of some widows during the inter-survey period, especially those whose spouses had died of AIDS
- Migration by widows out of the survey areas

In most societies in Uganda, it is very unusual to find households headed by married women explaining the low percentage of female heads that are married (42.2% in 1992 and 39.4% in 1995). Ntozi and Zirimenya attribute the small change in the married female heads to widows being inherited and continuing to stay in their late husbands' homes, or deciding to marry one of the late husband's relatives. The small proportion of households headed by persons under 18 years is attributed to the role played by the extended family system with children who lose both parents when they are too young to support themselves being looked after by relatives and friends (Ntozi and Mukiza-Gapere, 1995).

Alternatively an example of an investigation of the survival of households by their household composition in a setting similar to the GPC and aspects similar to those covered in this thesis is by Chirwa et al. (2004) in a longitudinal study investigating household dynamics in northern Malawi in the 1980s. The study is undertaken as part of an epidemiology study of leprosy and tuberculosis with households followed for five years. The household composition characteristics identified by Chirwa et al. were the size of households; age and sex of the household members and their position of household categorised as ‘head’, ‘member’ (child, spouse or other relative to the head of the household or of his or her

spouse), or 'other' (visitor, employed worker, renter or relative of the employed worker or renter).

Chirwa et al. observed the likelihood of a household's survival over time directly correlated with its size with single person households unstable and more likely to be absorbed into other households. Household survival was also higher in the male-headed households and those headed by older female adults (a finding similar to that reported at the IUSSP (1997) conference); while those headed by young females aged under 30 were found to be unstable.

Chirwa et al. also observes constant household change mainly attributed to the fact that people are constantly entering and leaving households though births, deaths and movement. The high rates of household composition change were attributed to movement among the adolescents and young adults. This movement was attributable primarily to marriage (as a woman leaves her parental home to join her husband (Mtika and Doctor, 2002)) and the search for employment opportunities as corroborated by Barratt et al.'s (2012) investigation of the movement of young adult aged 15–24 from rural to urban areas in Uganda.

A movement of adults aged over 30 particularly men, majority of whom were heads of household, was infrequent. However household composition change attributed to the older adults was as a result of separation or widowhood with custom dictating that women, not men, leave the marital home if the marriage comes to an end. The older women are then likely to leave and join one of their children's households, or go back to their original parental household. Child movement was also observed as children either moved with their mothers or were sent away to leave with close relatives in particular with grandparents.

3.4 Research hypotheses

Guided by the ALPHA-Network age categorisation of the residents in section 3.2.2, the residents aged less 15 years are classified as children, those aged between 15 and 59 as middle-aged adults and those aged more than 59 years as older adults. Further guided by the findings by other researchers and authors presented in sections 3.2 and 3.3, the following hypotheses are predicted:

1. Most households are headed by a man
2. There is an increase in married household heads with time with
    a. an increase in male heads who are married
    b. a decrease in the female heads that are married
3. There are very few child-headed households, decreasing over time; the majority are middle-aged
4. High dissolution rates are associated with households with:
    a. only a middle-aged woman resident
    b. an older adult, but no young adult resident
    c. a middle-aged woman as the household head
5. High migration rates are associated with a households with:
    a. only middle-aged adult residents
    b. an unmarried middle-aged man as the household head
6. Low dissolution rates are associated with households with:
    a. both a middle-aged man and young woman resident
    b. at least a child, middle-aged adult and older adult resident
7. Low migration rates are associated with a households with:
    a. at least one older adult resident
    b. at least a middle-aged woman and child resident
    c. an older adult as the household head
8. Household composition change is common in households with at least a middle-aged man or middle-aged woman resident but not both

a. Households with a child and middle-aged man resident with no middle-aged woman or older adult are likely to:
    i. relocate the children
    ii. have a middle-aged woman join the household
b. Households with a child and middle-aged woman are likely to:
    i. maintain this structure or
    ii. have an older adult join the household

The hypotheses are also graphically presented in Figure 7 showing the hypothesised changes in the household composition, those most likely to dissolve or migrate and the possible reasons for the predictions made.

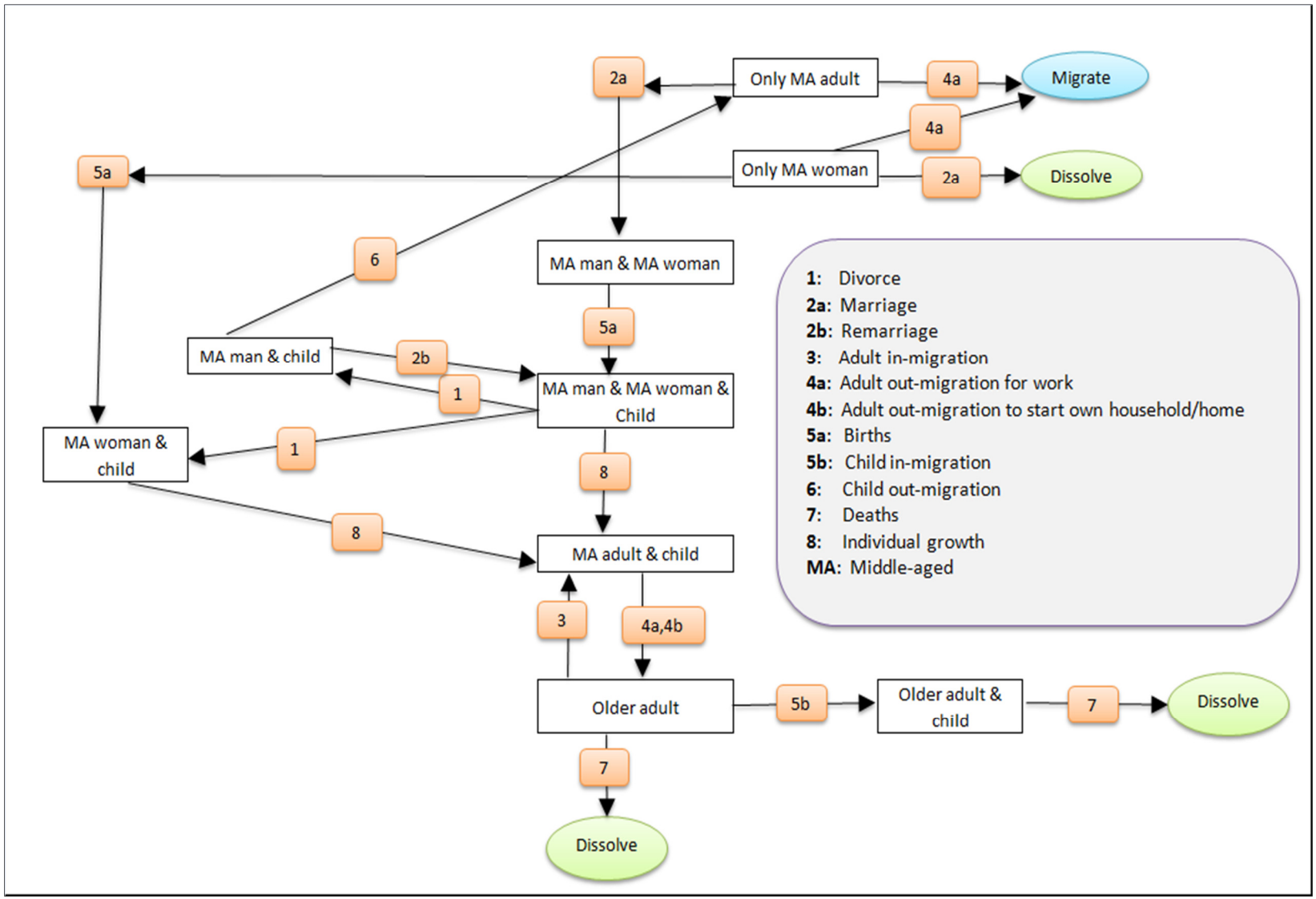

Figure 7: Graphical presentation of the research hypotheses observing household composition

3.5 The composition of the GPC households

The information collected on the GPC households in the census questionnaire enables the description of the households that participated in the GPC study between 1989 and 2008 by household size; dependency ratio; household headship by age, sex and residency of a spouse; proportion of adult household members that are male; and the age-sex distribution of all household members. Since Chapter 2 showed minimal differences in the characteristics in the households located in the old and new villages, the description of the households by their composition is not presented separately by the village location. This chapter presents the distribution of the households by the 19 surveillance survey periods summarised by the average distribution across the surveys and the households that had a particular characteristic at least once in the 19 surveillance surveys. A total of 7,875 households participated at least once in the study during the 19 surveillance surveys between 1989 and 2008, and an average of 2,716 households per surveillance survey.

3.5.1 Household size

The mean household size, shown in Figure 8 shows an average household size of 5.1 residents, highest in the first survey period 1989/1990 with an average size of 5.6 residents. Furthermore, survey period 1989/1990 had the largest category of the GPC household having more than 7 household members (26.1%), which dropped to 22.1%, a percentage below household size categories 2-3 and 4-5 household members, but rose again to the largest category (22.3%) in 2003/2004. One-person households were the smallest category from 1998 to 2008 (Figure 9, Appendix 8.3). Averaging the 19 survey periods, the largest category of households had 4-5 members. While looking at the number of households that had a particular household size at least once from 1998 to 2008, the largest category had 2-3 household members (Figure 10).

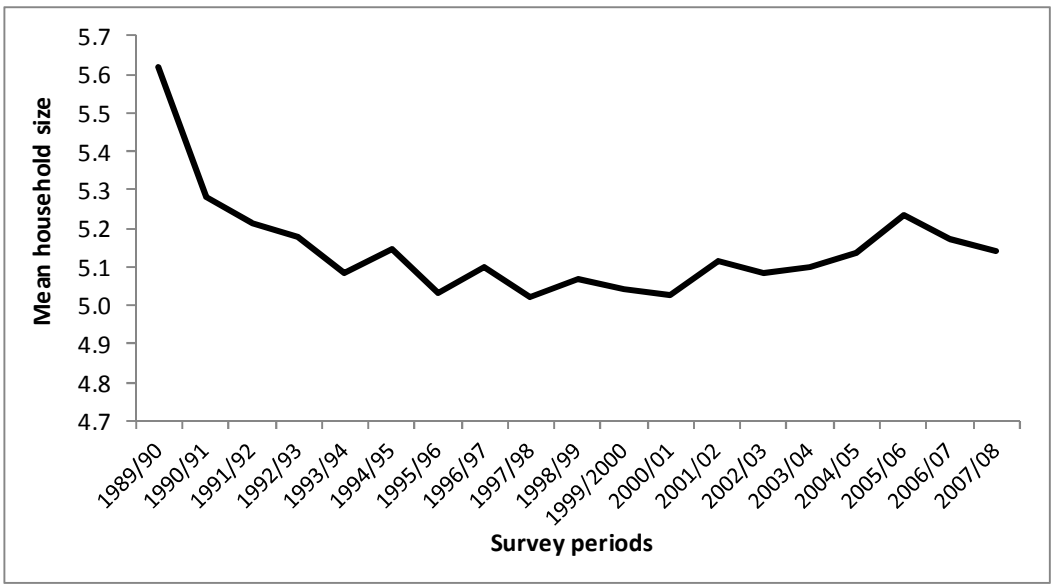

Figure 8: Mean household size by survey period

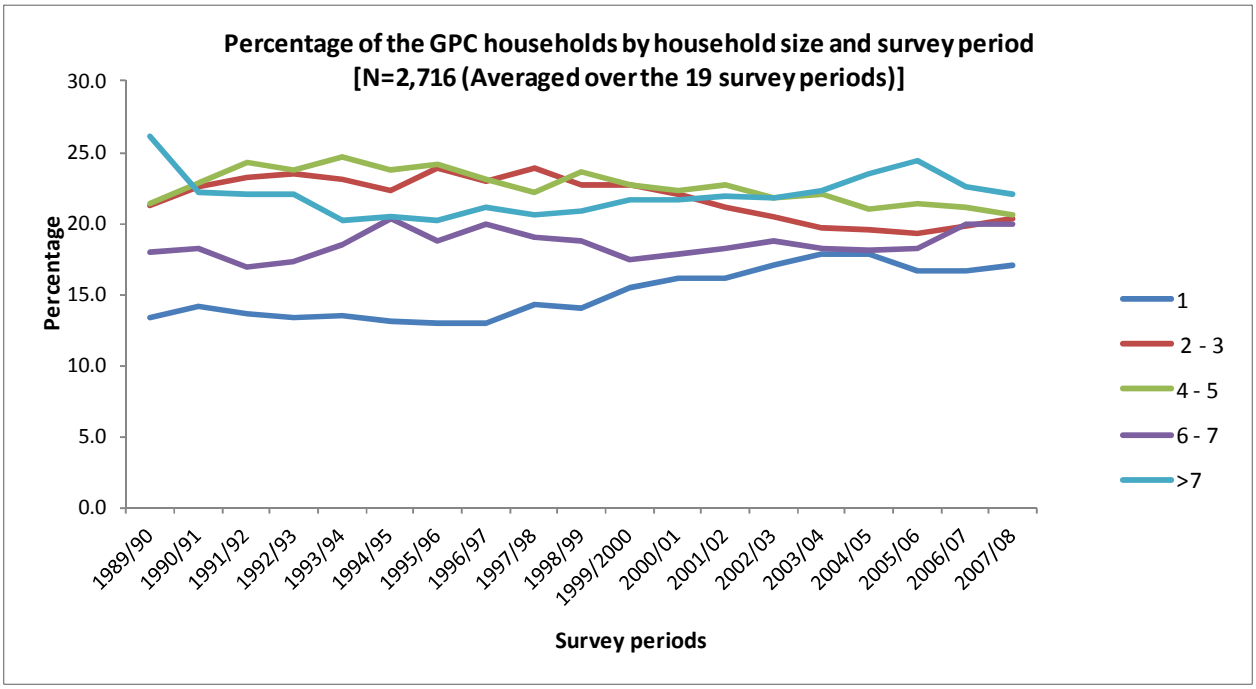

Figure 9: Percentage distribution of households by their size for the 19 surveillance surveys

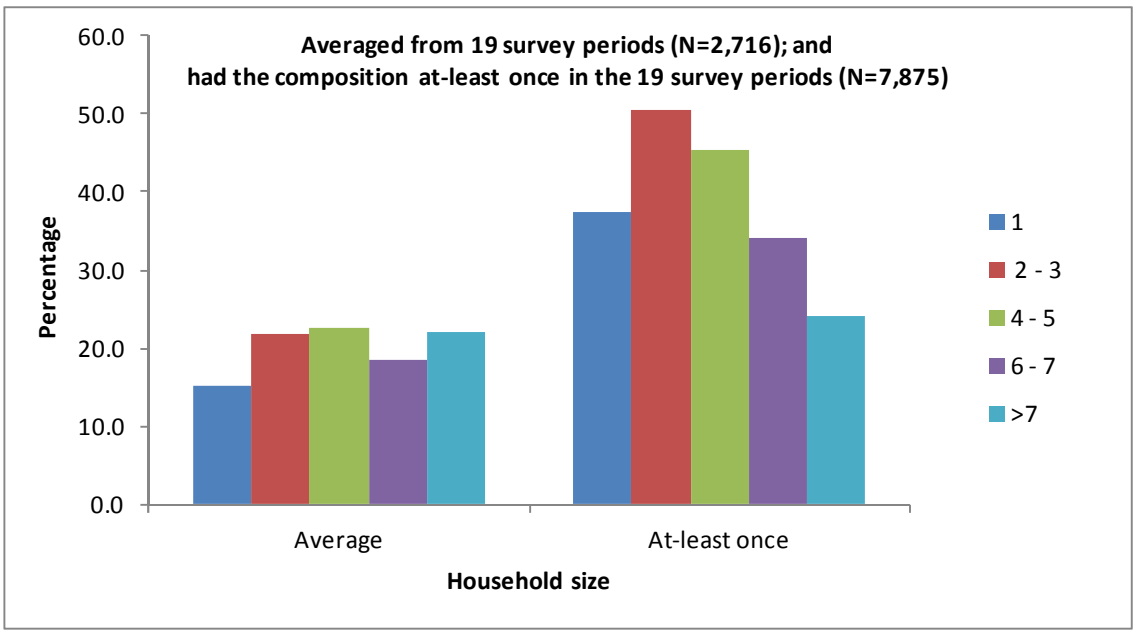

Figure 10: Summarised distribution of households by size

3.5.2 Dependency ratio

The dependency ratio is computed from the ratio of the number of dependants to productive household members or 'supporters'. In the GPC households dependants are aged less than 15 years or more than 59 years, and supporters are aged between 15 and 59 years. The age threshold for a child as 15 rather than 18 is chosen to ensure children are not mixed up with early marriages of 15 to 17 year old women, while 59 rather than 50 was used as the threshold for defining an older dependant as residents aged 50 to 59 in the GPC setting were still economically active.

There was little change in the distribution of the dependency ratio over the 19 survey periods. The largest category of the GPC households had a dependency ratio of less than 1 (an annual average of 47.8%), with 27.2% with a ratio of 0-0.5. (Figure 12, Appendix 8.4). On average 12.7% of households had a dependency ratio greater than 2.5 and in 7% of households the members were all dependants (Figure 11). Over 61% of households had a dependency ratio of 0-0.5 at least once between 1989 and 2009; 26% of households had a dependency ratio greater than 2.5, and 11.5% consisted only of dependants (Figure 11).

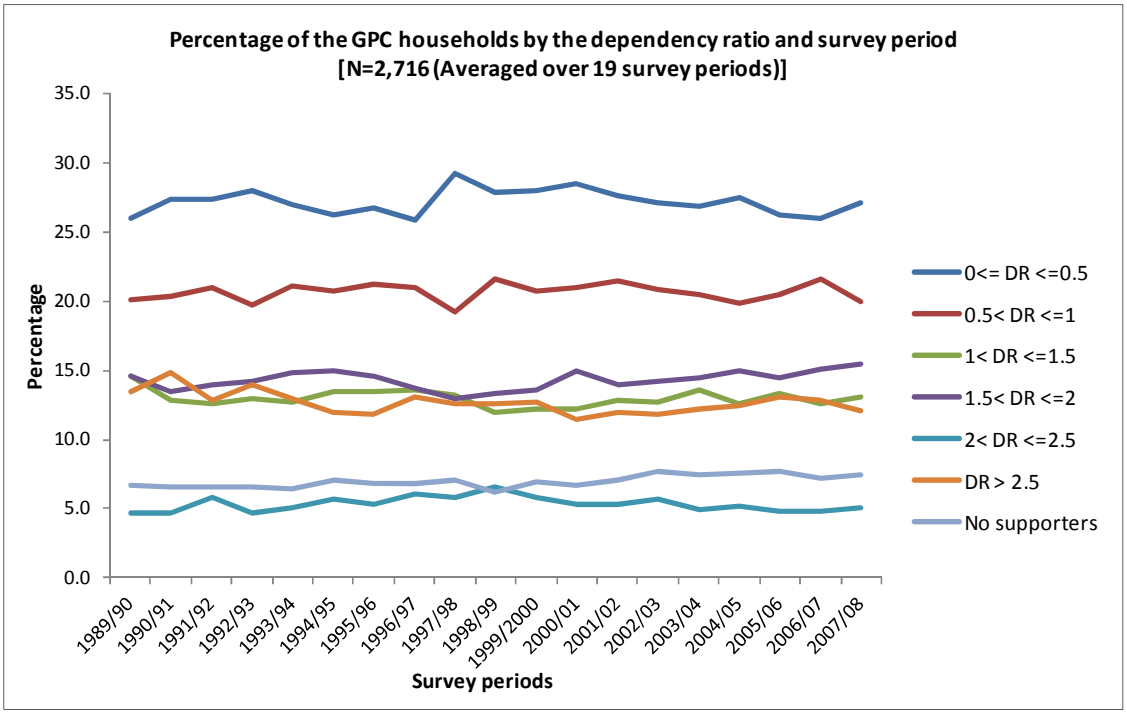

Figure 11: Summarised distribution of households by dependency ratio

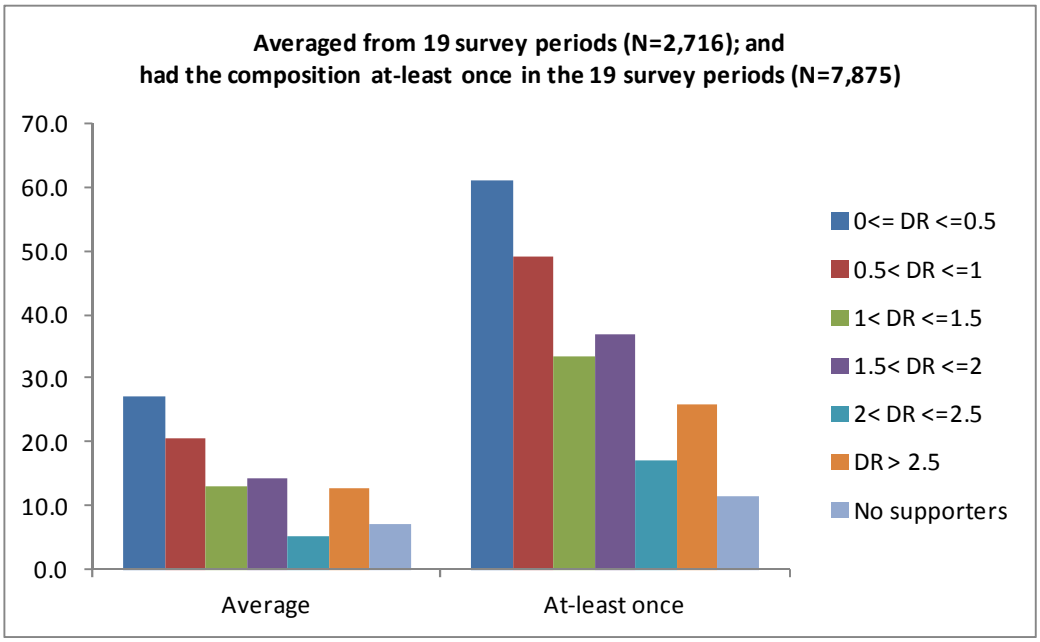

Figure 12: Percentage distribution of households by dependency ratio for the 19 survey periods

3.5.3 Household head characteristics

The characteristics of the household head used in the description of the composition of the GPC households are the age and sex of the head and whether the spouse of the head is living in the same household. Defining a married household head as one with a resident spouse, Figure 13 shows not much change in the percentage of households with a married household head with a fairly even distribution between households with a married and unmarried head (average of 54.8% of the households with a married head). Irrespective of the residence of a spouse, there was a decrease in the percentage of households headed by a man and a decrease in the percentage of male-headed households where the head was married (Figure 15). Very few households were headed by a child with an even further reduction in this percentage after survey period 1994/1995 (Figure 14). However, most households (an average of 75%) were headed by a middle-aged adult with not much change over the survey periods.

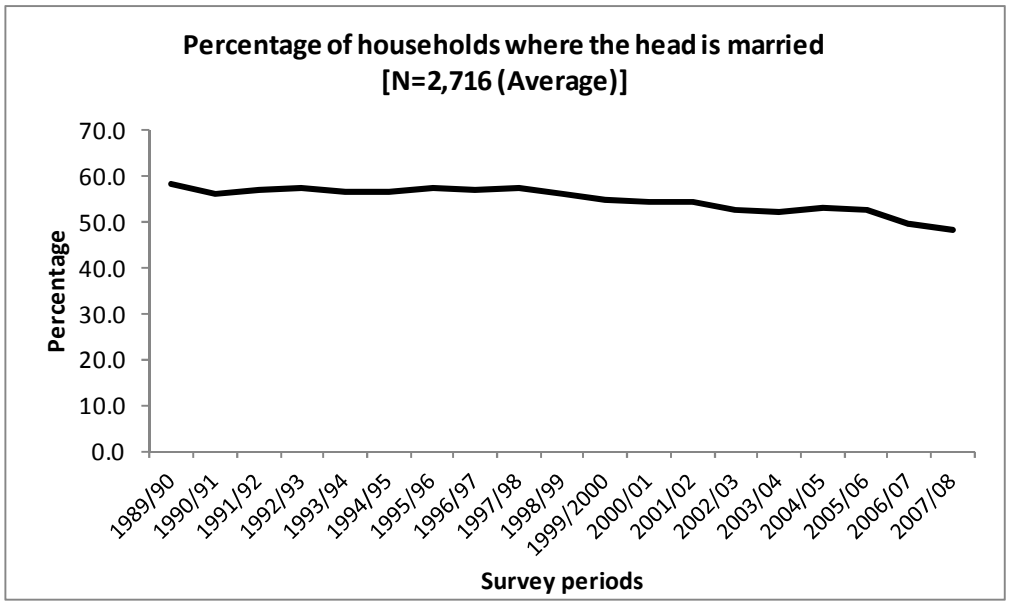

Figure 13: Percentage of households where the household head is married by survey period

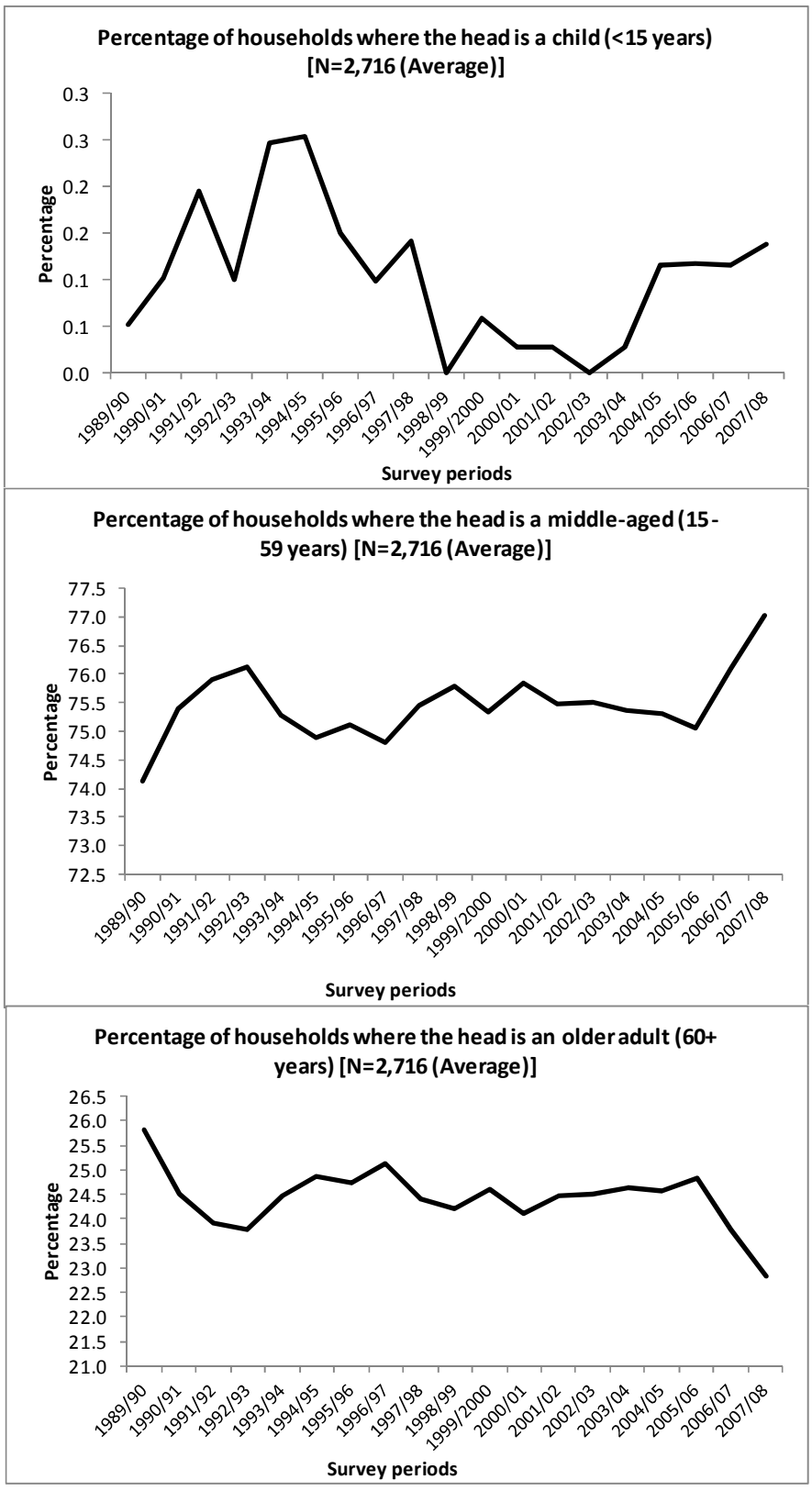

Figure 14: Percentage of households by age of the household head and by survey period

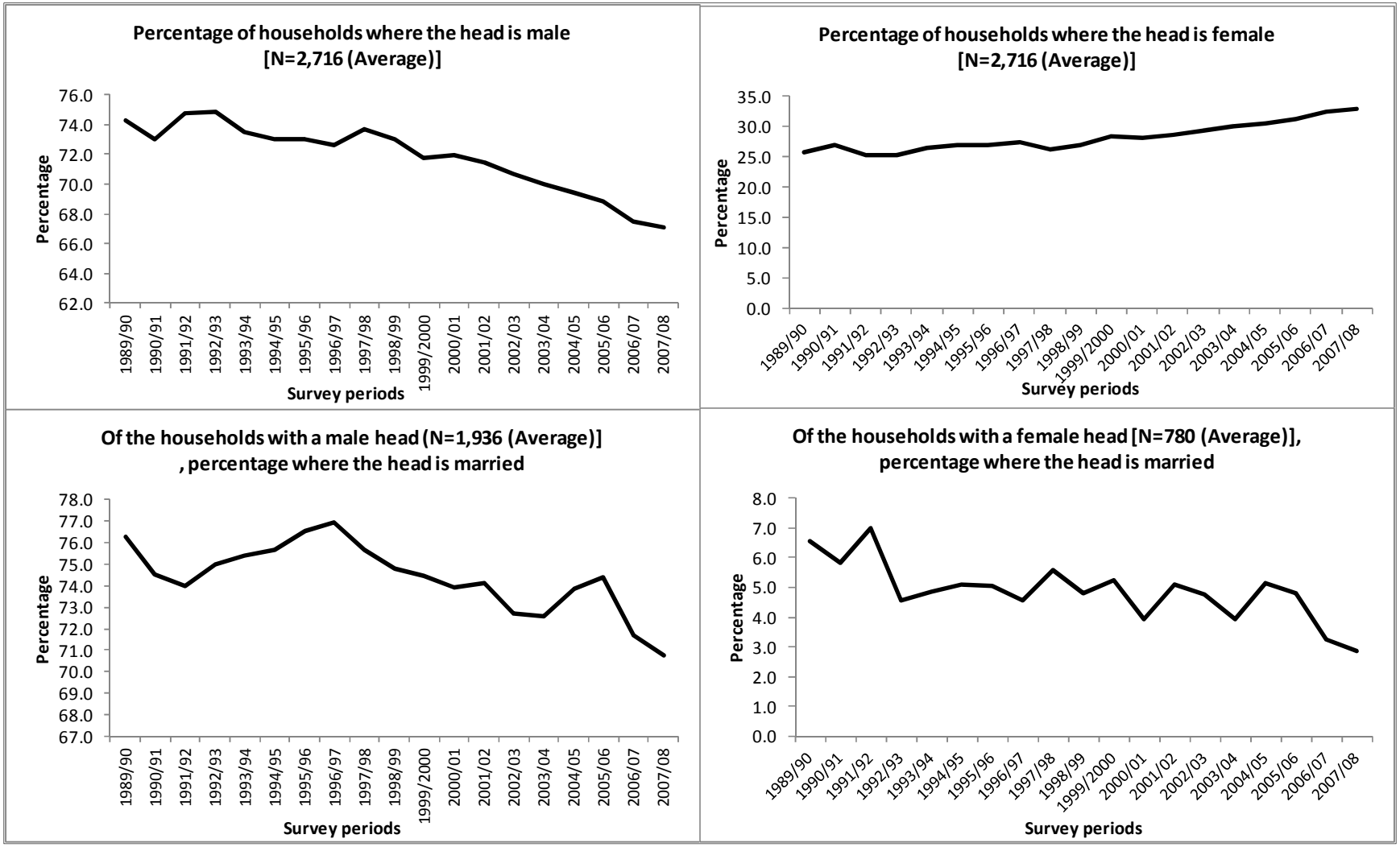

Figure 15: Percentage of households by the sex and marital status of the household head and the survey period

However, to create a single measure encompassing all of these characteristics, the households are categorised as follows:

- first they are categorised into those with a resident spouse and those without irrespective of the marital status reported during data collection
- then in each of the above categories, into male- or female-headed households
- finally, for each category above, the age of the household head (child < 15), middle-aged adult (15-59), or older adult (>59).

The final categories are thus as follows:

Resident spouse: Child Male head
Resident spouse: Middle-aged adult Male head
Resident spouse: Older adult Male head
Resident spouse: Middle-aged adult Female head
Resident spouse: Older adult Female head
Non Resident spouse: Child Male head
Non Resident spouse: Middle-aged adult Male head
Non Resident spouse: Older adult Male head
Non Resident spouse: Child Female head
Non Resident spouse: Middle-aged adult Female head
Non Resident spouse: Older adult Female head

A look at the distribution of the GPC households (Figure 16, Figure 17, Appendix 8.5) shows little change over time and a fairly even distribution between those with (annual average of 54.8%) and without a resident spouse. The largest category had a middle-aged male household head with a resident spouse (43%). Among the households with no resident spouse the largest category was headed by a middle-aged household head, 14.2% of whom are male and 17% female. Only 0.1% of households were child-headed. In addition, only 2.5% of the households with a resident spouse were headed by a woman while among those with a non-resident spouse 59.4% were headed by a woman.

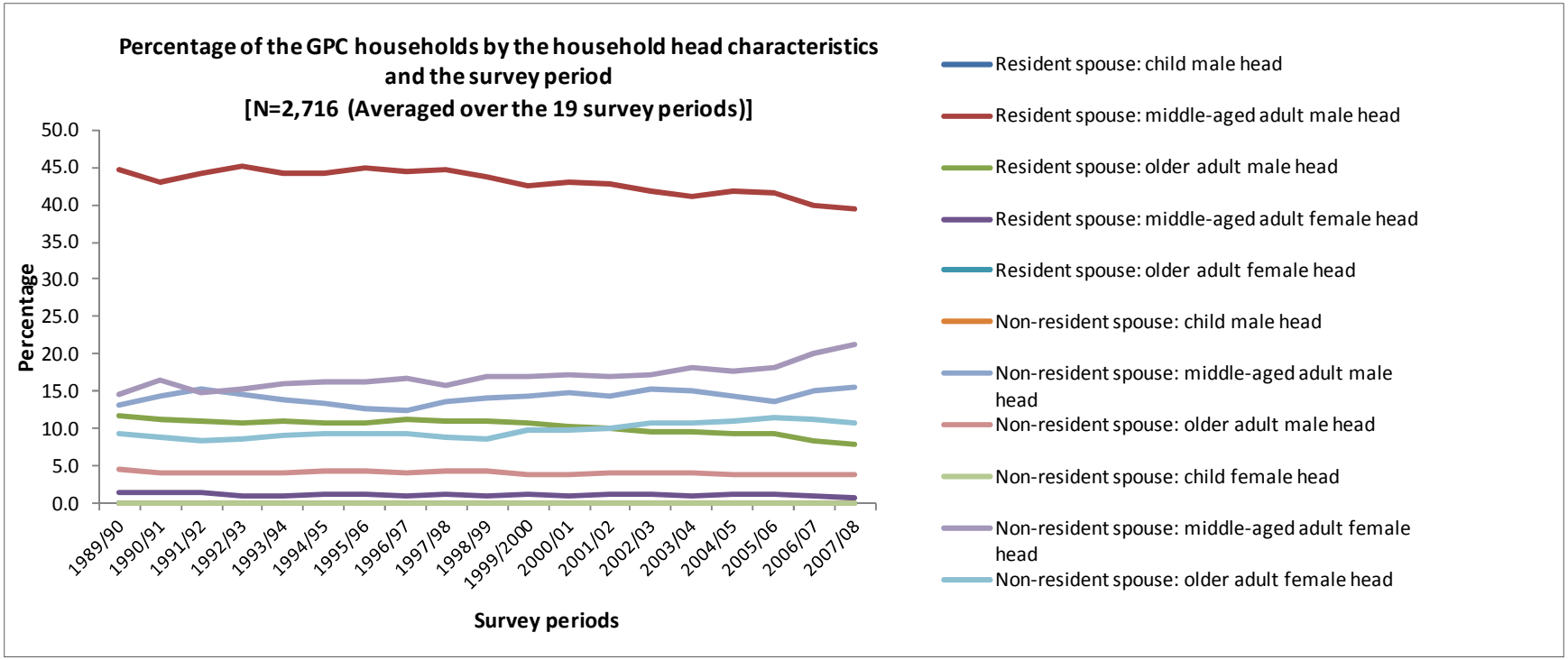

Figure 16: Percentage distribution of households by household head characteristics and village location for the 19 survey periods

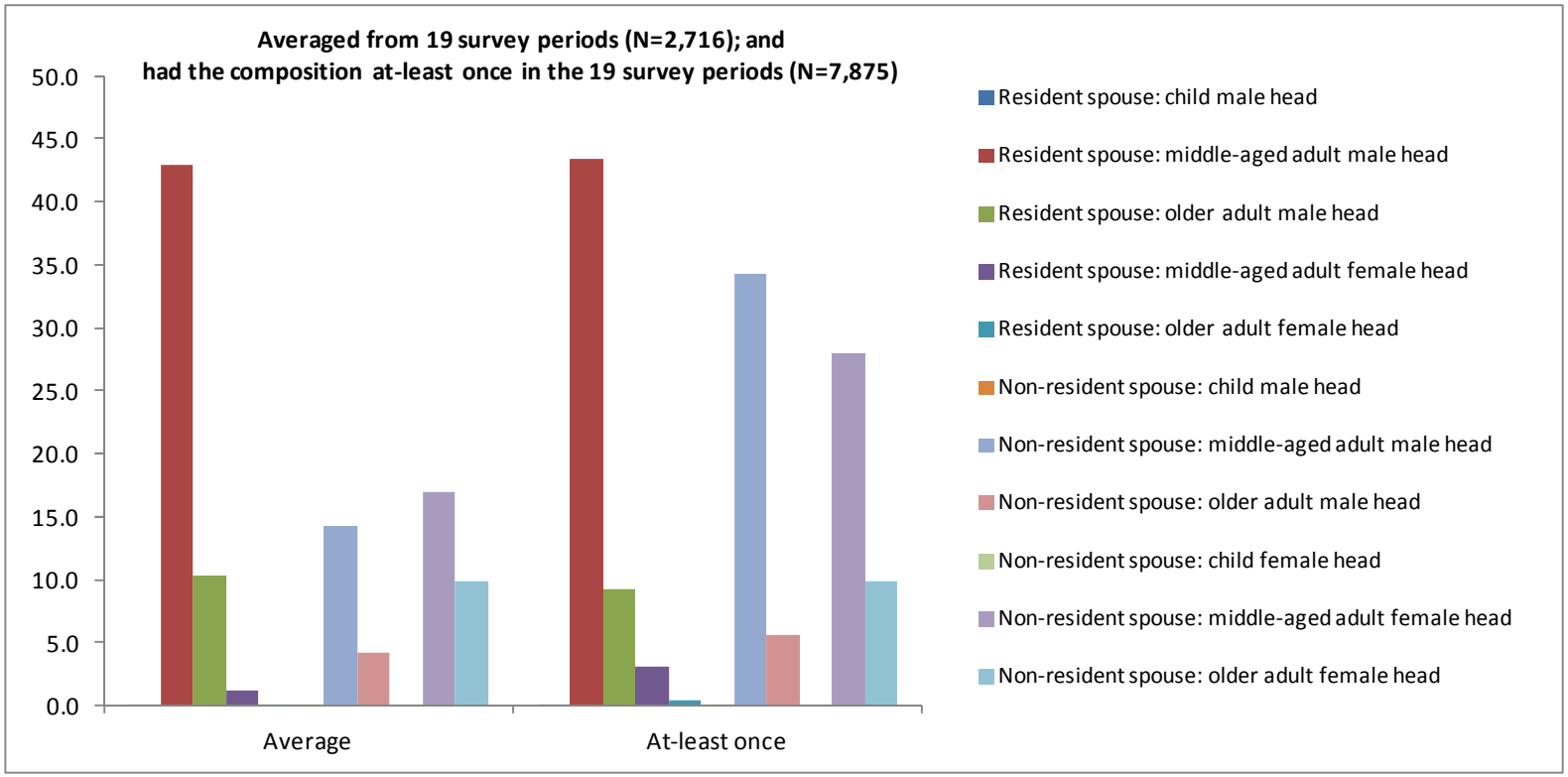

Figure 17: Summarised distribution of households by household head characteristics and village location

3.5.4 Sex distribution of the adult household members

Another category of household composition that can be used is the proportion of the productive adult (aged 15-59) residents who are male. This representation of household composition is used with the assumption that in an African rural setting, males are economically active while females take care of the home and children. Averaging the 19 survey periods, the distribution in the GPC households (Figure 18, Figure 19 Appendix 8.4) showed over 36.5% of the households evenly distributed by the sex of the adult residents, 16.2% with all adult residents, male, and 17.6% with all adult residents, female. A percentage of 11.5% of households lacked adult residents at least once during the 19 survey periods.

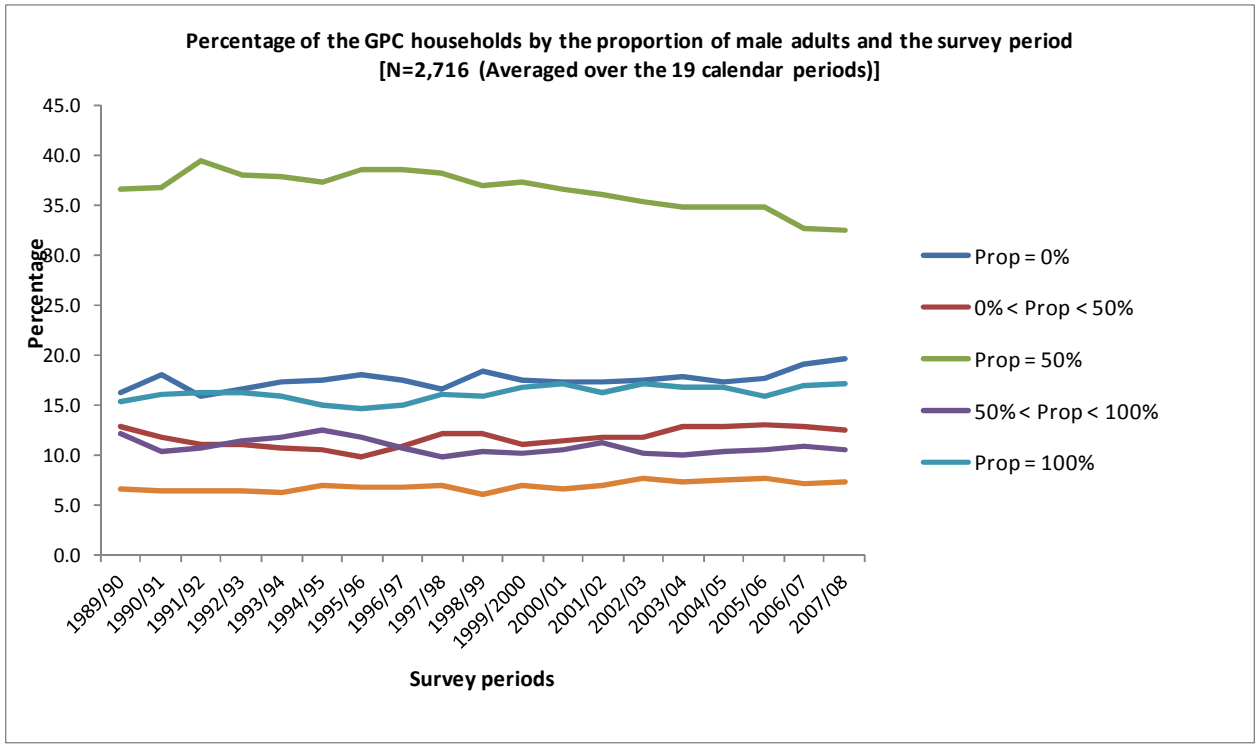

Figure 18: Percentage distribution of households by proportion of male adult residents for the 19 survey periods

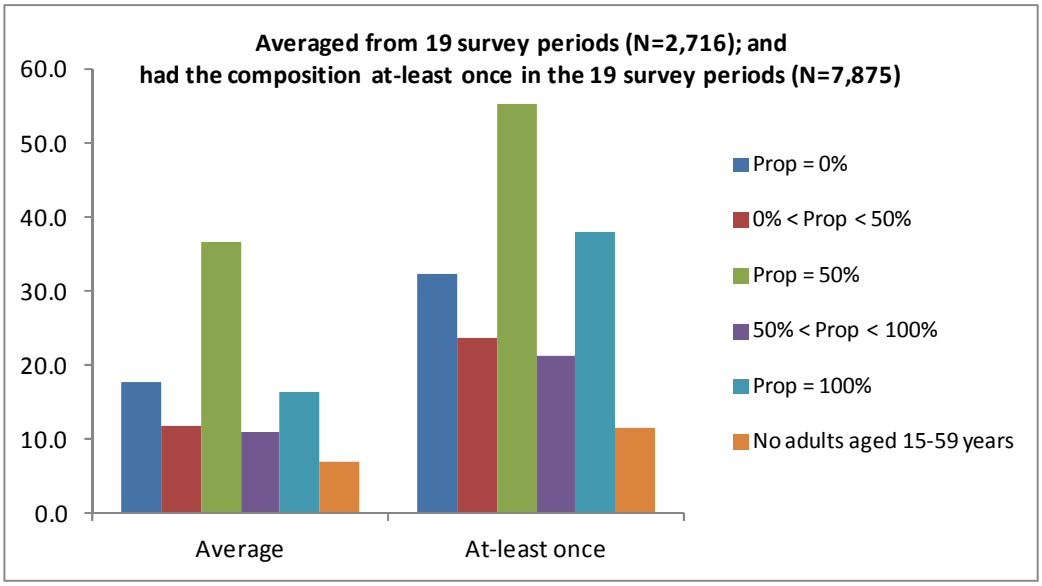

Figure 19: Summarised distribution of households by proportion (Prop) of male adult residents

3.5.5 Age-sex distribution

Unlike the sex distribution structure, this household structuring combines the age and sex distribution of all household members by applying a categorisation similar to that used by the ALPHA-Network. As illustrated in the hypothesis (section 3.4), unlike the ALPHA-Network, this thesis will classify the older adults as those aged more than 59 years (not 50 years as used by the ALPHA-Network). Therefore children remain aged less than 15 years and the middle-aged adults (referred to as 'young adults' under the ALPHA-Network) aged between 15 and 59 years.

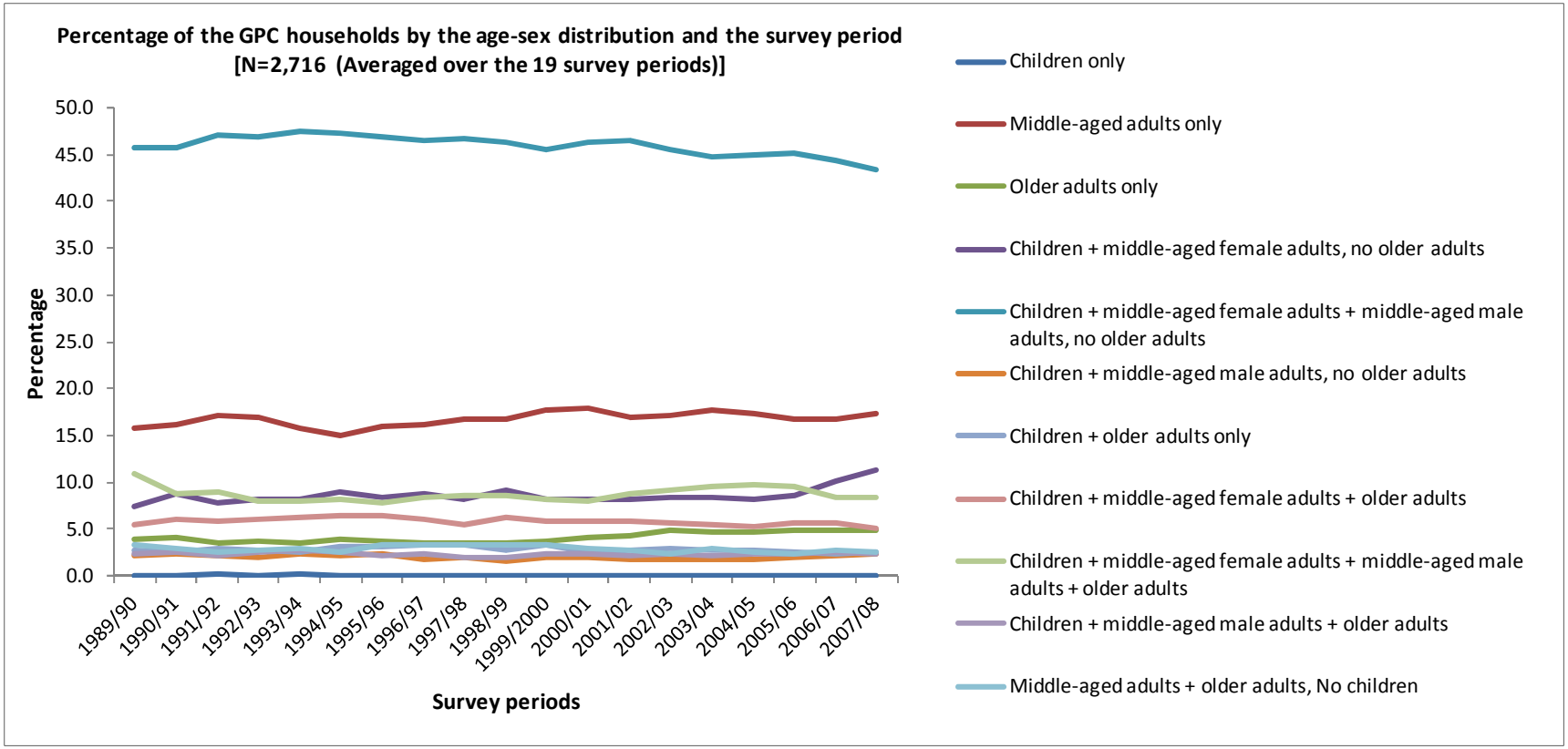

Figure 20: Percentage distribution of households by age-sex distribution and village location for the 19 survey periods

There was little change in the distribution of the GPC households over the 19 survey periods (as shown in Figure 20, Figure 21, Figure 23, Figure 24, and Appendix 8.7) with 46% of the households with a 'children + middle-aged female adults + middle-aged male adults, no older adults' structure; and 16.7% with a 'middle-aged adults only' structure of which 63% of 'middle-aged adults only' households, all the residents were male, and 23.5% included both male and female middle-aged adults. Only 0.2% of households consisted of a 'children only' structure at least once between 1989 and 2008, and 6.3% had a 'children + older adults only' structure at least once in the same period.

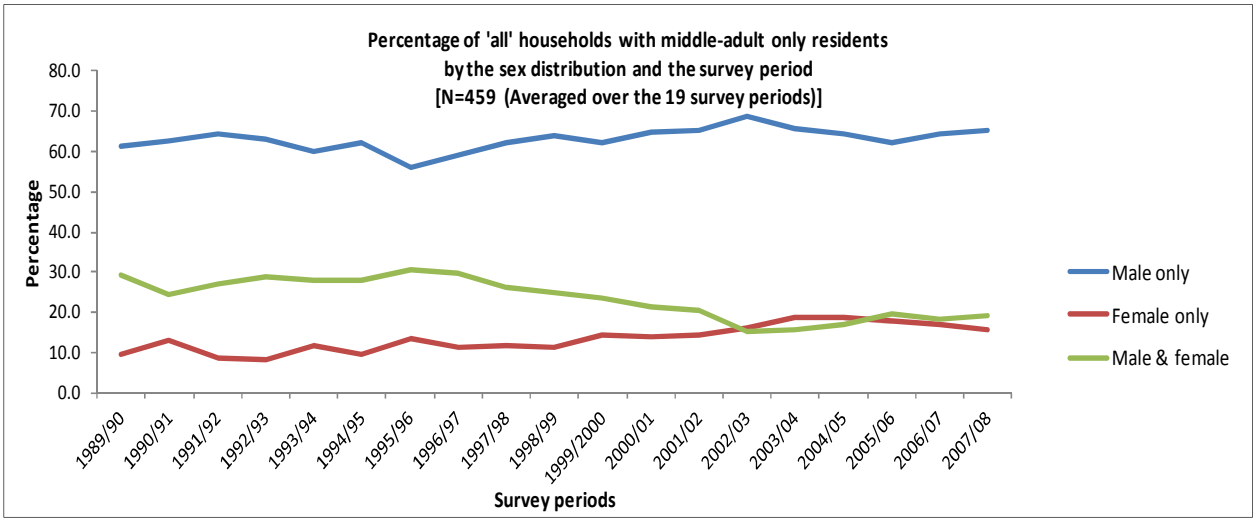

Figure 21: Percentage distribution of households with only middle-aged adults by sex distribution and village location for the 19 survey periods

A critical look at the distribution of each of the categories (Figure 22) also shows not much change in each of the categories, except for the common structures. Specifically, there was an increase in households with a 'middle-aged adults only' structure and a reduction in those with a 'children + middle-aged female adults + middle-aged male adults, no older adults' structure. Households with an 'older adult only' structure also increased

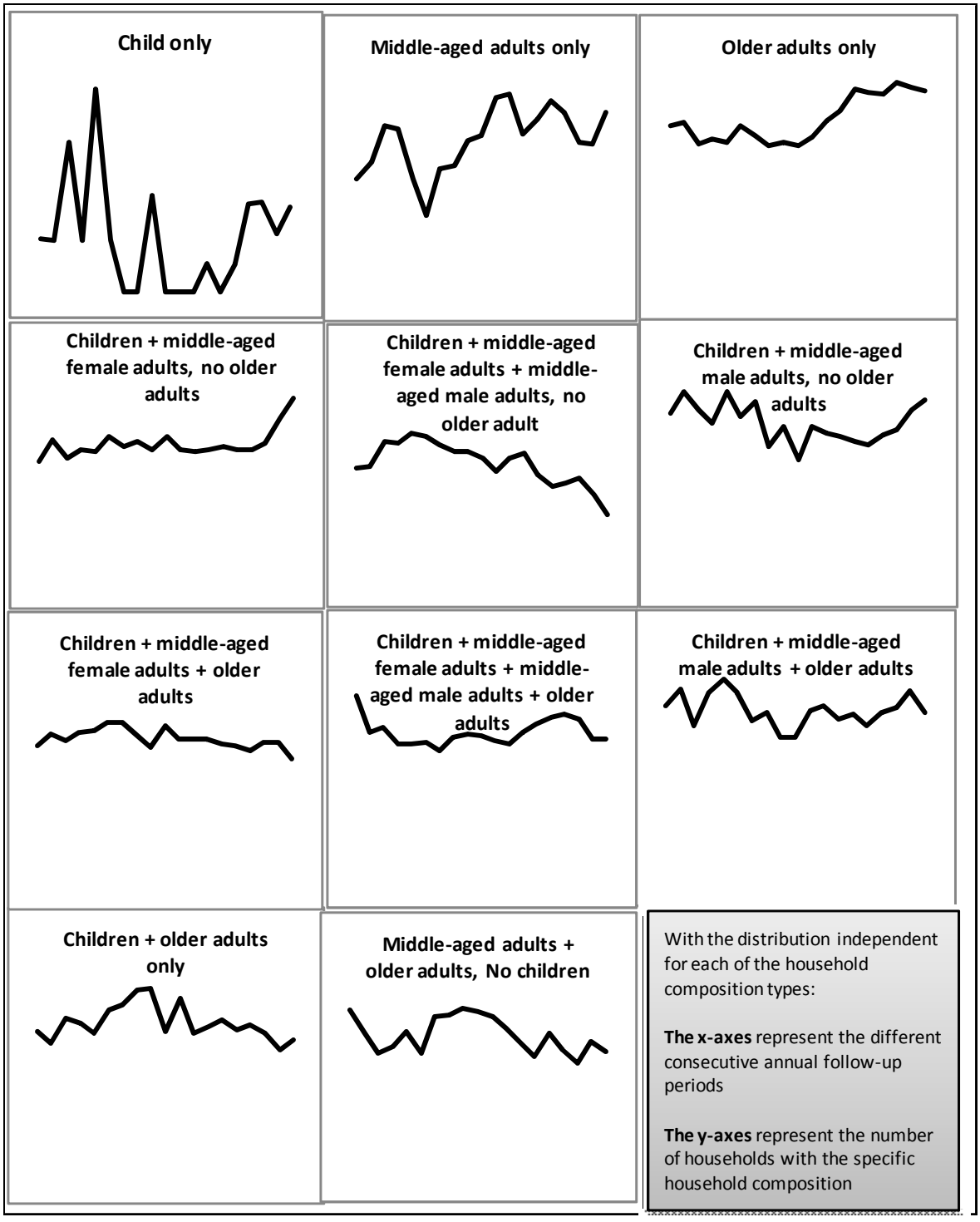

Figure 22: Further presentation of the distribution of households for each of the family relationship categorisation

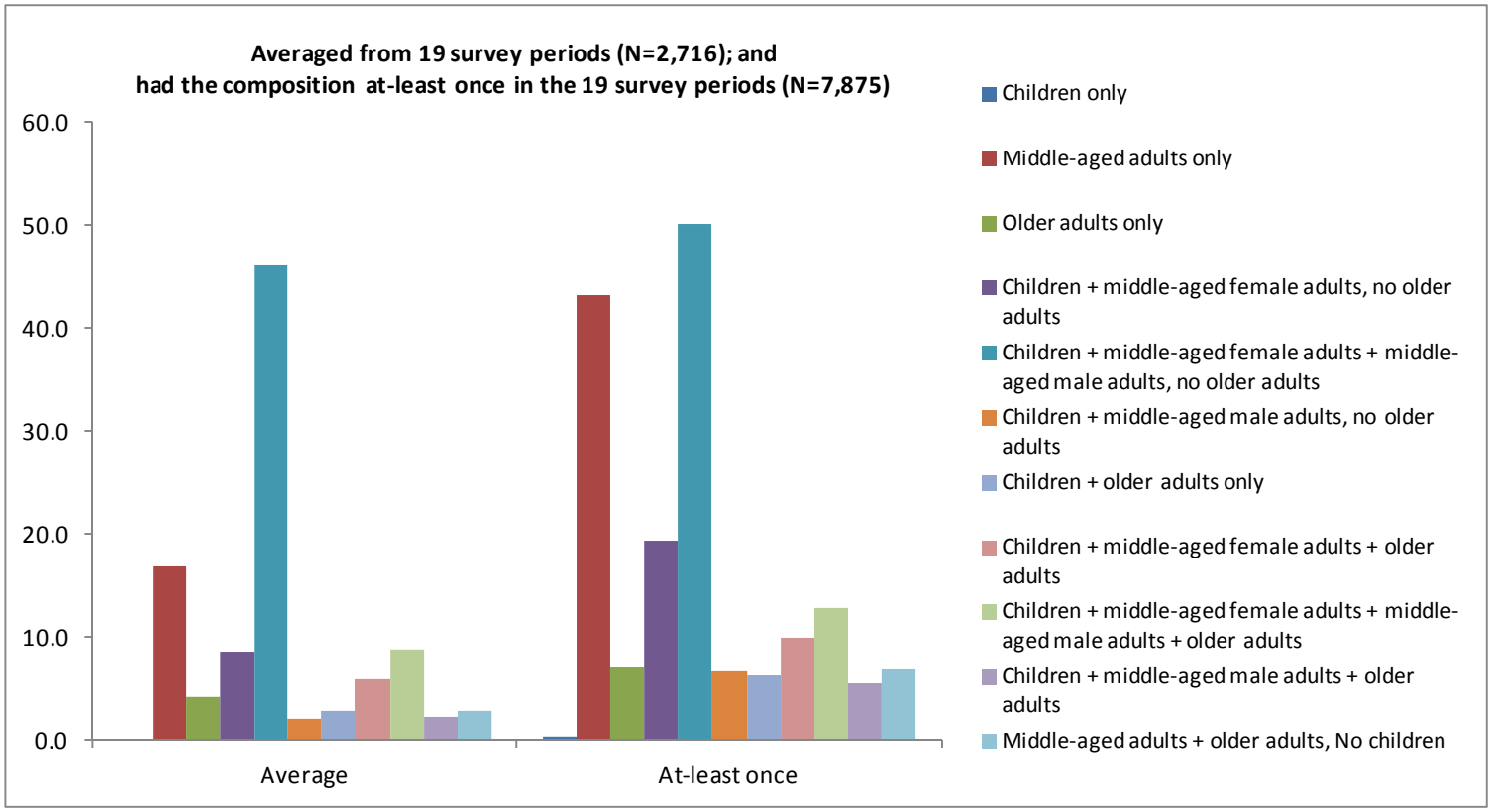

Figure 23: Summarised distribution of households by age-sex distribution

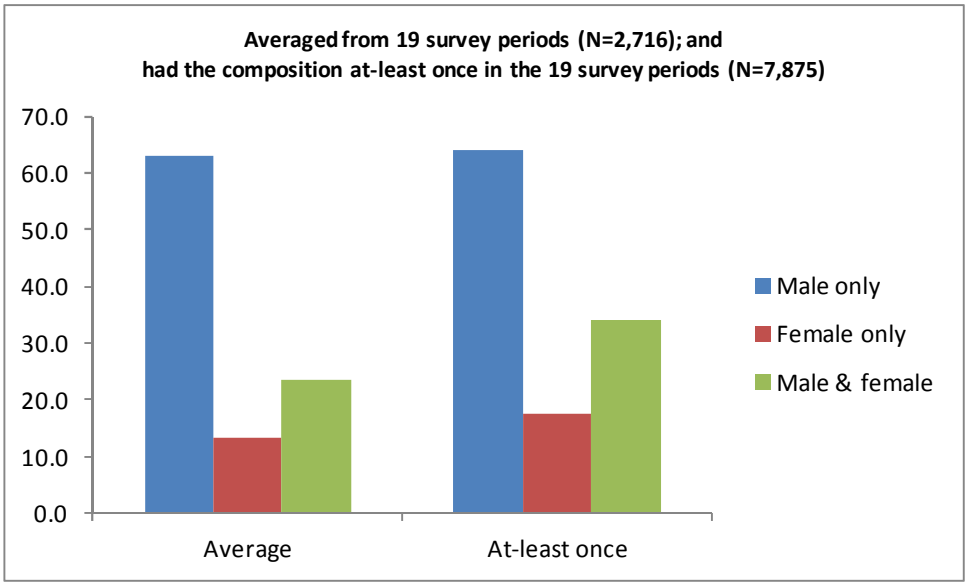

Figure 24: Summarised distribution of households with only middle-aged adult residents by sex

3.5.6 The choice of one household composition typology

At this point, I chose to use the age-sex typology to represent the composition structure of the household. However, how this typology relates to the other household composition descriptions illustrated in the sections above (that is household size, dependency ratio, household head characteristics and the proportion of productive adults that are male) needs to be determined. To do this, I compare the distribution of these composition descriptions in relation to the age-sex typologies. A comparison of the age-sex distribution and the household size (Figure 25) shows large households characterised by an age-sex distribution of a child, middle-aged adult and older adult living together, or a child with both a middle-aged man and middle-aged woman living together. The small households have only children, only middle-aged adults or only older adults in the household; or a middle-aged adult and an older adult living together.

A comparison of the of the age-sex distribution and the dependency ratio (Table 10) shows high dependency in households where a child and middle-aged woman live together with no

middle-aged man, or in those with a child, middle-aged man and older adult living together with no middle-aged woman.

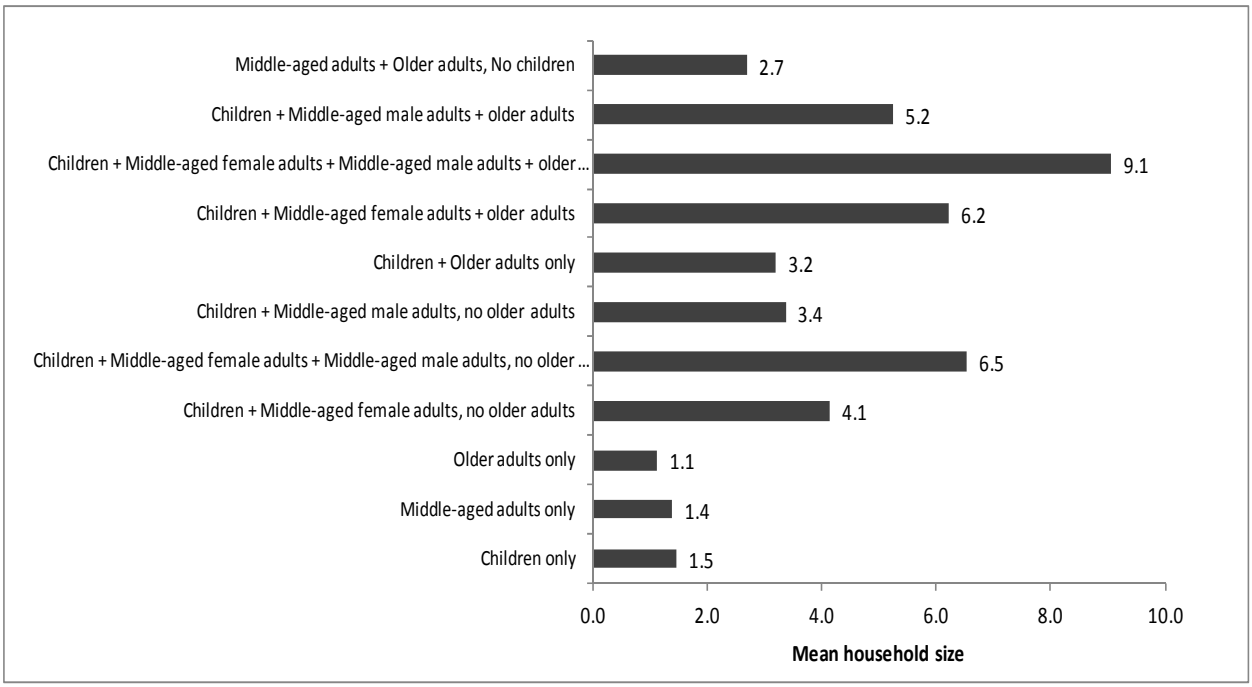

Figure 25: Mean household size by the age-sex distribution

Table 10: Mean household dependency ratio by the age-sex distribution

Age-sex distribution	Mean Dependancy ratio	Interpretation
Children only	.	No supporters
Middle-aged adults only	0.0	No dependents
Older adults only	.	No supporters
Children + Middle-aged female adults, no older adults	2.2	High
Children + Middle-aged female adults + Middle-aged male adults, no older adults	1.4	Moderate
Children + Middle-aged male adults, no older adults	1.7	Moderate
Children + Older adults only	.	No supporters
Children + Middle-aged female adults + older adults	3.5	High
Children + Middle-aged female adults + Middle-aged male adults + older adults	1.7	Moderate
Children + Middle-aged male adults + older adults	3.1	High
Middle-aged adults + Older adults, No children	0.9	Low

Table 11: Percentage distribution of the age-sex distribution by the household head characteristics

Age-sex distribution	Household head characteristics											Overall percentage of 51,606 household entries
	Resident spouse: Child Male head	Resident spouse: Middle-aged adult Male head	Resident spouse: Older adult Male head	Resident spouse: Middle-aged adult Female head	Resident spouse: Older adult Female head	Non Resident spouse: Child Male head	Non Resident spouse: Middle-aged adult Male head	Non Resident spouse: Older adult Male head	Non Resident spouse: Child Female head	Non Resident spouse: Middle-aged adult Female head	Non Resident spouse: Older adult Female head	
Children only	0.0	0.0	0.0	0.0	0.0	**61.5**	0.0	0.0	**38.5**	0.0	0.0	**0.1**
Middle-aged adults only	0.0	**16.4**	0.0	0.7	0.0	0.0	**65.5**	0.0	0.0	**17.4**	0.0	**16.9**
Older adults only	0.0	0.0	6.9	0.0	0.1	0.0	0.0	**52.1**	0.0	0.0	**40.8**	**4.2**
Children + Middle-aged female adults, no older adults	0.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	**99.4**	0.0	**8.7**
Children + Middle-aged female adults + Middle-aged male adults, no older adults	0.0	**84.4**	0.0	2.0	0.0	0.0	2.6	0.0	0.0	11.0	0.0	**45.8**
Children + Middle-aged male adults, no older adults	0.0	6.6	0.0	0.0	0.0	0.2	**93.2**	0.0	0.0	0.0	0.0	**2.0**
Children + Older adults only	0.0	0.0	16.0	0.0	0.8	0.0	0.0	16.4	0.0	0.0	**66.8**	**2.8**
Children + Middle-aged female adults + older adults	0.0	0.0	**56.1**	1.0	0.3	0.0	0.0	4.8	0.0	5.3	**32.4**	**5.8**
Children + Middle-aged female adults + Middle-aged male adults + older adults	0.0	11.8	**53.7**	0.9	0.3	0.0	0.8	4.8	0.0	4.2	**23.5**	**8.8**
Children + Middle-aged male adults + older adults	0.0	0.9	**26.3**	0.0	2.4	0.0	4.6	9.9	0.0	0.0	**55.8**	**2.3**
Middle-aged adults + Older adults, No children	0.0	1.2	**31.1**	0.5	0.5	0.0	3.6	17.6	0.0	2.3	**43.0**	**2.8**

A comparison of the age-sex distribution and the household head characteristics (Table 11) shows households with:

- at least one older adult resident being headed by an older adult with those headed by a man having a resident spouse and those headed by a woman having no resident spouse.
- only a middle-aged adult are commonly headed by a man with no resident spouse
- a child living together with both a middle-aged man and middle-aged woman with no older adult commonly headed by a man with a resident spouse

Finally a comparison of the age-sex distribution and the proportion of male productive adult residents (aged 15 – 59 years) is done for households with at least a middle-aged man and middle-aged woman living together (Table 12). This shows an even distribution of men and women residents in households where the middle-aged adults are living with at least a child or an older adult; and more men in households where there are only middle-aged adults living together.

Table 12: Mean proportion of male adults of productive age to the females by age-sex distribution

Age-sex distribution of households with at least a middle-aged man and middle-aged woman living together	Mean proportion of productive male adult residents (aged 15 -59 years)	Interpretation
Middle-aged adults only	74.9	High
Children + Middle-aged female adults + Middle-aged male adults, no older adults	49.9	Even
Children + Middle-aged female adults + Middle-aged male adults + older adults	47.6	Even
Middle-aged adults + Older adults, No children	59.3	Even

3.5.7 Summarising the structure of the GPC households based on their composition characteristics

In conclusion, the cross-sectional investigation of the distribution of the GPC households by their household composition characteristics over the 19 survey periods showed not much difference across the surveys. However, the distribution shows an average household size of 5.1 residents and most with a dependency ratio less than 1 (showing more supporters

relative to the dependants). The distribution also shows a fairly even distribution of married and non-married heads with most married heads being middle-aged men and those with un-married heads being middle-aged adults with a fairly evenly sex distribution. However it is important to observe that, 9 out of 10 of the female heads are unmarried. Most households are headed by a middle-aged adult or a man. Child headed households are rare. A reduction of households headed by a man is observed over time along with a reduction of men heads that are married. The distribution of the middle-aged adult residents shows an even sex distribution, while most households have a child living together with both a middle-aged man and middle-aged woman; or only middle-aged adults living together.

The choice is made to use the typology pulling together the age and sex of the household residents (referred to as 'age-sex distribution' in the thesis) to represent the compositional structure of the household. It is this typology that is used in the longitudinal analysis undertaken later in this chapter and in Chapter 5 where the findings in this chapter are built upon to incorporate the aspects of HIV infection and adult mortality. However, the typology can be related back to the other household composition characteristics (specifically the household size, dependency ratio, sex distribution of middle-aged adult residents and the household head characteristics) especially to enable the comparison with findings by other researchers or authors who use these different household characteristics.

3.5.8 Relating the cross-sectional findings to the hypotheses

I first hypothesised that most households were headed by a man which was true for the GPC data however the distribution of headship by sex showed a reduction of male heads over time.

The second hypothesis states that there is an increase in married household heads with time. However the data shows a fairly even distribution of married and unmarried heads with not much change over time. Also contrary to the hypothesis, the GPC distribution showed some decrease in the number of male heads that are married and not much change in the distribution of the female heads that are married over time

The third hypothesis states very few child headed households, decreasing over time; while most household heads are middle-aged adults. The GPC shows child headed households were very rare throughout the survey periods while most household heads were indeed middle-aged.

3.6 Longitudinal investigation of an association between household composition and household dissolution and migration

Using the age-sex distribution typology to represent a household's composition structure, a longitudinal analysis is undertaken to investigate whether there is an association between a household composition and its likelihood to dissolve or migrate. This analysis is reported in this section. To effectively investigate this, I follow households annually (SFPs) and over four to five year periods (LFPs) to observe dissolution or migration outcomes with reference to their composition at baseline. The baseline and FPs are described in Section 1.4.3 in Chapter 1. The analysis generates short-term and long-term rates of dissolution and migration (generated per 100 HYRS) in relation to each of the age-sex distribution types, and then the rate ratios in reference to the structure with the least rate to enable the adjustment for the effect of survey period and village location.

Table 13: Short-term rates and rate ratios of dissolution and migration stratified by the household's compositional characteristics

Age-Sex distribution (Short term analysis)	Number of households	Household dissolution				Household migration			
		Dissolved	Rates[1]	Rate ratio[2]	p-value	Migrated	Rates[1]	Rate ratio[2]	p-value
Children only	17	4	**25.8**	**30.6**	< 0.001	6	**38.7**	**24.5**	< 0.001
Middle-aged adults only	3,152	396	**5.6**	**7.0**	< 0.001	1,144	**16.3**	**10.8**	< 0.001
Older adults only	517	158	**8.5**	**10.8**	< 0.001	75	4.0	2.7	< 0.001
Children + Middle-aged female adults, no older adults	1,391	216	**5.9**	**7.3**	< 0.001	411	**11.2**	**7.4**	< 0.001
Children + Middle-aged female adults + Middle-aged male adults, no older adults	3,779	170	0.8	1.0	-	929	4.4	2.9	< 0.001
Children + Middle-aged male adults, no older adults	482	39	**4.7**	**5.7**	< 0.001	107	**12.8**	**8.5**	< 0.001
Children + Older adults only	459	57	**4.5**	**5.5**	< 0.001	46	3.6	2.4	< 0.001
Children + Middle-aged female adults + older adults	757	22	0.8	1.0	0.990	61	2.2	1.5	0.025
Children + Middle-aged female adults + Middle-aged male adults + older adults	955	41	1.0	1.2	0.202	61	1.5	1.0	-
Children + Middle-aged male adults + older adults	409	19	1.8	2.2	0.001	23	2.2	1.4	0.158
Middle-aged adults + Older adults, No children	507	39	3.0	3.7	< 0.001	53	4.1	2.7	< 0.001

[1]: Rates per 100 household years (HYRS)

[2]: Rate ratio relative to the least rate and accounting for the village location and follow-up period

Table 14: Long-term rates and rate ratios of dissolution and migration stratified by the household's compositional characteristics

Age-Sex distribution (Long term analysis)	Number of households	Household dissolution				Household migration			
		Dissolved	Rates[1]	Rate ratio[2]	p-value	Migrated	Rates[1]	Rate ratio[2]	p-value
Children only	3	1	**16.8**	**23.5**	0.002	1	**16.8**	**12.5**	0.013
Middle-aged adults only	1,489	231	**4.2**	**5.8**	< 0.001	571	**10.5**	**8.6**	< 0.001
Older adults only	321	114	**7.8**	**11.0**	< 0.001	56	3.8	3.2	< 0.001
Children + Middle-aged female adults, no older adults	719	126	**4.4**	**6.1**	< 0.001	228	**8.0**	**6.6**	< 0.001
Children + Middle-aged female adults + Middle-aged male adults, no older adults	2,743	138	0.7	1.0		646	3.4	2.8	< 0.001
Children + Middle-aged male adults, no older adults	189	20	2.9	4.0	< 0.001	53	**7.7**	**6.4**	< 0.001
Children + Older adults only	254	56	**5.0**	**6.8**	< 0.001	40	3.6	2.9	< 0.001
Children + Middle-aged female adults + older adults	459	26	1.0	1.4	0.096	41	1.6	1.4	0.153
Children + Middle-aged female adults + Middle-aged male adults + older adults	646	38	1.0	1.3	0.147	48	1.2	1.0	-
Children + Middle-aged male adults + older adults	203	23	2.4	3.2	< 0.001	15	1.5	1.3	0.445
Middle-aged adults + Older adults, No children	268	40	3.3	4.5	< 0.001	44	3.7	3.0	< 0.001

[1]: Rates per 100 household years (HYRS)

[2]: Rate ratio relative to the least rate and accounting for the village location and follow-up period

Table 15: Summarising the short-term and long-term rates (per 100 HYRS) of dissolution and migration by household composition structure

Age-sex distribution	Rates of dissolution		Rates of migration	
	SFP	LFP	SFP	LFP
Children only	**25.8**	**16.8**	**38.7**	**16.8**
Middle-aged adults only	**5.6**	**4.2**	**16.3**	**10.5**
Older adults only	**8.5**	**7.8**	4.0	3.8
Children + Middle-aged female adults, no older adults	**5.9**	**4.4**	**11.2**	**8.0**
Children + Middle-aged female adults + Middle-aged male adults, no older adults	0.8	0.7	4.4	3.4
Children + Middle-aged male adults, no older adults	**4.7**	2.9	**12.8**	**7.7**
Children + Older adults only	**4.5**	**5.0**	3.6	3.6
Children + Middle-aged female adults + older adults	0.8	1.0	2.2	1.6
Children + Middle-aged female adults + Middle-aged male adults + older adults	1.0	1.0	1.5	1.2
Children + Middle-aged male adults + older adults	1.8	2.4	2.2	1.5
Middle-aged adults + Older adults, No children	3.0	3.3	4.1	3.7

3.6.1 Household dissolution

Looking first at the association between household composition and household dissolution (represented in Table 13, Table 14 and Table 15), both the short-term and long-term analyses show the households most likely to dissolve have the age-sex distribution:

- children only
- middle-aged adults only
- older adults only
- children + middle-aged female adults, no older adults
- children + older adults only.

Those least likely to dissolve have the age-sex distribution

- children + middle-aged female adults + middle-aged male adults, no older adults

- children + middle-aged female adults + older adults
- children + middle-aged female adults + middle-aged male adults + older adults.

In addition, households with a 'children + middle-aged male adults, no older adults' age-sex distribution are observed to also be likely to dissolve, but only in the long-term.

Including the aspect of headship as shown in Table 16, among the households commonly headed by a middle-aged adult, those likely to dissolve either had no child, or no middle-aged man or no middle-aged woman resident. Among those headed by an older adult, those most likely to dissolve had no middle-aged adult resident. The aspect of household size shows large households are less likely to dissolve. A look at the proportion of middle-aged adult males shows households with a more middle-age men than women are more likely to dissolve.

3.6.2 Household migration

The investigation of the association between household composition and household migration both in the short-term and long-term (Table 13, Table 14 and Table 15), shows that households most likely to migrate have age-sex distribution:

- children only
- middle-aged adults only
- children + middle-aged female adults, no older adults
- children + middle-aged male adults, no older adults.

Those least likely to migrate have age-sex distribution:

- children + middle-aged female adults + older adults
- children + middle-aged female adults + middle-aged male adults + older adults
- children + middle-aged male adults + older adults.

Table 16: Comparison of household dissolution and migration rates for the different household composition characteristics

Commonly headed by a middle-aged adult	**Dissolution rates**	**Migration rates**
Middle-aged adults only	HIGH	HIGH
Children + Middle-aged female adults, no older adults		
Children + Middle-aged male adults, no older adults		
Children + Middle-aged female adults + Middle-aged male adults, no older adults	LOW	LOW
Commonly headed by an older adult		
Children + Middle-aged female adults + older adults	LOW	LOW
Children + Middle-aged female adults + Middle-aged male adults + older adults		
Children + Middle-aged male adults + older adults		
Children + Older adults only	HIGH	
Older adults only		
Middle-aged adults + Older adults, No children		
Large households		
Children + Middle-aged female adults + Middle-aged male adults + older adults	LOW	LOW
Children + Middle-aged female adults + older adults		
Children + Middle-aged male adults + older adults		
Children + Middle-aged female adults + Middle-aged male adults, no older adults		
Small households		
Children only	HIGH	HIGH
Middle-aged adults only		
Older adults only		LOW
Middle-aged adults + Older adults, No children	Moderate	
High Dependency ratio		
Children + Middle-aged female adults, no older adults	HIGH	HIGH
Children + Middle-aged female adults + older adults	LOW	LOW
Children + Middle-aged male adults + older adults		
High proportion of middle-aged men		
Middle-aged adults only	HIGH	HIGH
Even sex distribution of middle-aged adults		
Children + Middle-aged female adults + Middle-aged male adults, no older adults	LOW	LOW
Children + Middle-aged female adults + Middle-aged male adults + older adults		
Middle-aged adults + Older adults, No children	Moderate	

Including the aspect of household headship as shown in Table 16, among the households commonly headed by a middle-aged adult, those likely to migrate either had no child, or no middle-aged man or no middle-aged woman resident. Those headed by an older adult were less likely to migrate. The aspect of household size shows that large households are less likely to migrate. Among the small households those less likely to migrate have at least one older adult resident. Among those with a high dependency ratio, those with at least one older adult were less likely to migrate. Those with a high proportion of male middle-aged adults are likely to migrate.

3.6.3 Summarising the longitudinal investigation of an association between the household's compositional structure and household dissolution or household migration

In conclusion, the dissolution and migration of the households seems to be attributed to the residency of an older adult or the co-residency of children with both a middle-aged man and middle-aged woman. Households where there is no co-residency of a middle-aged man and a middle-aged woman or with no middle-aged adult resident are most likely to dissolve. Households with a child living together with both a middle-aged man and middle-aged woman or a child living with a middle-aged adult and an older adult are least likely to dissolve. Similarly, households with a child living with a middle-aged adult and an older adult are least likely to migrate, but more likely to migrate if the older adult is not resident.

3.7 Longitudinal investigation of the changes in household composition over time

This section investigates the change in the household composition of the GPC households over time, using the longitudinal principle applied in the previous section. Household information at baseline is observed for any change in household composition over four to five years (LFP) split into four time intervals described in Table 17. The five most common age-sex distributions are investigated:

- children + middle-aged female adults + middle-aged male adults, no older adults

- middle-aged adults only
- children + middle-aged female adults, no older adults
- children + middle-aged female adults + middle-aged male adults + older adults
- children + middle-aged female adults + older adults

plus:

- children + middle-aged male adults, no older adults and
- children + middle-aged male adults + older adults.

Despite being uncommon, the last two additional age-sex distributions provide for comparison to the other household compositional structures, specifically the 'children + middle-aged female adults, no older adults', and the 'children + middle-aged female adults + older adults' structures.

Using a principle similar to the transition probabilities concept, the age-sex distribution at the start and end of the LFP among the households that survive to the end of the LFP is identified. Unlike the transition probabilities concept where proportions are generated, I instead generated the percentage of surviving households by change in the composition. At baseline, the age-sex distributions of interest are identified and followed for the first four to five survey periods (LFPa) to identify the changes in the composition. These households are followed for a further four to five survey periods (LFPb) to observe the additional changes or return of migrated or households lost to follow-up at the end of the LFPa.

Table 17: Description of the follow-up periods

Follow-up intervals	Description of the long term follow-up periods						
	Baseline survey period	Follow-up period (LFPa)			Additional follow-up period (LFPb)		
		Number of surveys in the follow-up period	Start	End	Number of surveys in the follow-up period	Start	End
1	1989/1990	5	1990/1991	1994/1995	5	1995/1996	1999/2000
2	1994/1995	5	1995/1996	1999/2000	5	2000/2001	2004/2005
3	1999/2000	4	2000/2001	2003/2004	4	2004/2005	2007/2008
4	2003/2004	4	2003/2004	2004/2005	-	- *	- *

*: No additional follow-up undertaken as the survey periods are outside the year range considered in the thesis

Table 18: Comparison of age-sex distribution changes between the LFPa and LFPb

Baseline age-sex distribution	Follow-up (FP)	Survived to the end of the FP		Did not survive to the end of the FP
		Same distribution at the end of the FP	Different distribution at the end of the FP	
Middle-aged adults only	LFPa	25.0	28.2	46.8
	LFPb	38.4	25.0	37.3
Children + Middle-aged female adults, no older adults	LFPa	28.7	41.7	29.6
	LFPb	29.3	40.8	29.9
Children + Middle-aged female adults + Middle-aged male adults, no older adults	LFPa	63.7	17.3	19.0
	LFPb	69.8	18.8	11.4
Children + Middle-aged male adults, no older adults	LFPa	13.5	49.5	37.0
	LFPb	23.5	52.9	23.5
Children + Middle-aged female adults + older adults	LFPa	32.4	54.2	13.5
	LFPb	31.3	54.2	14.6
Children + Middle-aged female adults + Middle-aged male adults + older adults	LFPa	44.7	43.7	11.6
	LFPb	50.5	40.4	9.1
Children + Middle-aged male adults + older adults	LFPa	22.3	57.9	19.8
	LFPb	22.9	54.3	22.9

A comparison of the change patterns during LFPa and LFPb shows similar patterns of change between the FPs (Table 18). It can therefore be concluded that a look at one of the FPs is appropriate to observe the patterns of change. Observing households of the seven selected age-sex distributions over LFPa (Table 19) shows the most change among households of age-sex distribution:

- children + middle-aged male adults, no older adults (49.5% of the households)
- children + middle-aged female adults + older adults (54,2%)
- children + middle-aged male adults + older adults (57.9%).

The least change was among households of a 'children + middle-aged female adults + middle-aged male adults, no older adults' distribution (17.3%).

Households with age-sex distributions:

- middle-aged adults only (35.5%)

- children + middle-aged female adults, no older adults (25.8%) or
- children + middle-aged male adults, no older adults (43.5%)

commonly changed to the 'children + middle-aged female adults + middle-aged male adults, no older adults' structure. In addition, households with a 'children + middle-aged male adults, no older adults' distribution (24.4%) also commonly changed to the 'middle-aged adults only' structure. Further, those with distributions:

- children + middle-aged female adults + older adults (27.4%) or
- children + middle-aged male adults + older adults (18.7%)

commonly changed to the 'children + middle-aged female adults + middle-aged male adults + older adults' distribution with those with a 'children + middle-aged male adults + older adults' (16.7%) also changing to the 'children + older adults' distribution. And those with a 'children + middle-aged female adults + middle-aged male adults + older adults' structure commonly changed to distributions:

- children + middle-aged female adults + older adults (18.1%)or
- children + middle-aged female adults + middle-aged male adults, no older adults (10.1%).

Table 19: Percentage of age-sex distribution change occurring during the LFP

Percentage classification of the structural changes in 4/5year follow-up periods	Baseline age-sex distribution						
	Middle-aged adults only	Children + Middle-aged female adults, no older adults	Children + Middle-aged female adults + Middle-aged male adults, no older	Children + Middle-aged male adults, no older adults	Children + Middle-aged female adults + older adults	Children + Middle-aged female adults + Middle-aged male adults + older adults	Children + Middle-aged male adults + older adults
Children only	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Middle-aged adults only	**47.0**	6.7	4.7	**24.4**	0.4	1.0	2.5
Older adults only	5.2	0.8	0.1	1.5	3.0	1.6	7.1
Children + Middle-aged female adults, no older adults	4.6	**49.2**	4.5	0.0	5.2	2.4	0.0
Children + Middle-aged female adults + Middle-aged male adults, no older adults	**35.5**	**25.8**	**78.7**	**43.5**	4.6	10.1	2.5
Children + Middle-aged male adults, no older adults	2.2	0.0	2.2	**21.4**	0.0	0.4	0.5
Children + Older adults only	1.4	3.5	0.5	2.3	8.5	3.6	**16.7**
Children + Middle-aged female adults + older adults	1.2	7.9	2.1	0.8	**37.4**	**18.1**	**10.1**
Children + Middle-aged female adults + Middle-aged male adults + older adults	0.8	3.5	6.0	4.6	**27.4**	**50.5**	**18.7**
Children + Middle-aged male adults + older adults	0.4	1.3	0.8	0.8	3.9	6.9	**27.8**
Middle-aged adults + Older adults, No children	1.7	1.3	0.4	0.0	9.6	5.3	**14.1**
Number of households from which the percentages are generated	967	520	3,990	131	540	867	198

3.8 Household member movement as an explanation of household survival or composition change

An investigation into the reasons why members may leave a household or join another could shed some light on the reasons of household change. To do this, all the events of individual participants leaving a GPC household or joining a GPC household between 1989 and 2008 are grouped together and percentage of individuals that gave a specific reason for movement is summarised in Table 20 and Table 21 by individual age group and sex.

Table 20: Percentage distribution of household member movement by the reason of joining another household

Reason for joining another household	Age group in years			Total	Aged 15 - 59		Aged 60+	
	<15	15 - 59	60+		Female	Male	Female	Male
New born	**32.1**	0.1	0.0	**21.2**	0.1	0.0	0.0	0.0
Joining relatives/fostered	**58.5**	**38.0**	**33.4**	**51.4**	**35.3**	**42.0**	**39.8**	**25.1**
Marriage including rejoining husband/wife after separation / divorce	0.2	**19.5**	4.0	6.5	**30.3**	3.1	2.7	5.6
Work	0.7	**20.3**	**15.0**	7.2	**11.2**	**34.0**	2.7	**31.1**
School	5.1	3.4	0.0	4.5	3.0	4.2	0.0	0.0
Divorce	0.0	6.7	2.8	2.2	**11.0**	0.3	4.0	1.2
Hunger/famine	0.0	2.1	2.8	0.7	0.1	5.1	0.0	6.4
Death	0.0	0.1	0.2	0.0	0.0	0.1	0.3	0.0
To assist/give help	1.4	1.3	2.4	1.4	1.2	1.3	3.3	1.2
Treatment	1.5	3.2	1.2	2.1	2.7	4.1	1.5	0.8
Refugee/ asylum	0.2	3.5	**29.7**	1.7	3.9	2.9	**36.8**	**20.3**
Number of joiners	23,206	11,364	580	35,151	6,847	4,517	329	251

Starting with the reasons for joining another household (Table 20), among the children (aged less than 15 years), common reasons were:

- to live or be fostered by relatives (59%)
- as a new born (32%).

Among those aged 15 -59 years, the women's main reasons were to:

- join other relatives (35%); or
- in marriage (30%)

while among the men was to:

- join other relatives (42%); or
- work (34%).

And among those aged over 59 years, the main reasons were:

- to join other relatives (33%); or
- as a refugee seeking asylum (30%)
- and specifically among the men joining to work (31%).

Table 21: Percentage distribution of household member movement by the reason of leaving a household of residence

Reason for leaving the household	Age group in years			Total	Aged 15 - 59		Aged 60+	
	<15	15 - 59	60+		Female	Male	Female	Male
New born	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Joining relatives/fostered	**76.5**	**25.2**	**19.5**	**50.7**	**24.0**	**26.8**	**23.5**	**15.1**
Marriage including rejoining husband/wife after separation / divorce	1.0	13.0	0.8	6.5	**22.0**	1.1	1.1	0.4
Work	2.7	**34.7**	4.6	**17.5**	**21.9**	**51.4**	0.8	8.8
School	**10.2**	6.8	0.0	8.3	6.4	7.4	0.0	0.0
Divorce	0.1	9.3	1.8	4.4	**15.5**	1.0	1.9	1.8
New settlement	0.1	0.3	0.3	0.2	0.1	0.4	0.3	0.4
Other	0.2	0.3	0.2	0.2	0.2	0.4	0.2	0.2
Hunger/famine	7.4	8.5	**62.0**	**10.1**	7.8	9.5	**57.6**	**66.8**
Death	1.4	0.8	0.2	1.1	0.7	1.0	0.2	0.2
To assist/give help	0.2	0.9	**10.2**	0.9	1.2	0.5	**14.1**	6.0
Treatment	0.1	0.3	0.4	0.2	0.2	0.4	0.3	0.5
Refugee/ asylum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of leavers	15,183	13,916	1,194	30,294	7,911	6,005	625	569

Looking at the reasons for leaving a household (Table 21), child commonly had the reason of:

- living with or being fostered by relatives (77%)
- school (10%)

Women aged 15-59 left:

- to join other relatives (24%)
- in marriage (22%)
- to work (22%)

; while the men aged 15-59 left to:

- work (51%), or
- join relatives

For those aged more than 59 years, the common reasons were:

- hunger/famine (62%)
- join relatives (20%)
- and specifically among women, 14% to assist or give help to other households

3.9 Final discussion of Chapter 3 findings

In this chapter, a univariate analysis was undertaken longitudinally investigate household dynamics relative to the household's composition. This follows from Chapter 2 where the techniques of tracing households were investigated and a technique chosen and used to trace GPC households over 19 years. This chapter undertook the task of determining whether a household's composition was associated with the survival of the household and observed the patterns of household composition change over time. The classification of the GPC households by their household composition showed GPC households with an average household size of five household members and most households with:

- a dependency ratio less than 1 showing more supporters to dependants (dependents aged under 15 years or over 59 years),
- an even sex distribution of residents aged between 15 and 59 years,
- a male household head with 3 out of 4 living with a spouse,
- a household head aged between 15 and 59 years, and
- a child (aged less than 15 years) living with both a man and woman resident aged 15-59 years

The distribution thus agrees with the hypothesis that most households were headed by a man but this percentage is decreasing over time. Since the majority of these heads are young adults, the reductions in the numbers of these heads can be attributed to the young men leaving the households to work. Work/employment was reported as the common reason for young men leaving the GPC households (Section 3.8) and also observed by Barratt et al (2012). On the other hand, child headed households are rare and also decreasing over time. These small proportions of households headed by persons under 15 years were also observed by Ntozi and Zirimenya (1999), attributing this to the role played by the extended family system in looking after the children and absorbing them into their households (Ntozi and Mukiza-Gapere, 1995). However, Ntozi and Zirimenya (1999) observed this practice by the extended family while observing households that experienced a death in the household. This will therefore be discussed more when I look at the aspect of adult mortality in Chapter 5.

The findings, however, disagree with the hypothesis that there is an increase in married household heads over time by showing not much change over time. This could be attributed to a reduction in separation or divorce, widows inherited or remarried, or widows migrating outside the study area. These same reasons were also observed by Ntozi and Zirimenya (1999). By sex of the married heads, in the GPC setting as in most societies in Uganda, a low percentage of female heads are married. This can be attributed to the cultural gender perspective of headship where the man in the marriage is commonly considered as the household head. Since the identification of headship is done by the respondents during the GPC interviews, the identified household head depends on the household member interviewed and marriage situation in the household. For example, if the man is not contributing to the welfare of the household and the wife is interviewed, the woman may identify herself as the household head.

3.9.1 Household dissolution

Household composition was found to be associated with the dissolution of households. Defining a child as one aged less than 15 years, middle-aged adult aged between 15 and 59 years and an older adult aged more than 59 years, households most likely to dissolve had:

- only a child, or middle-aged adult, or older adult resident in the household;
- no middle-aged resident; or
- child and only a middle-aged man or middle-aged woman (not both) and no older adult resident.

It is assumed that child only households are commonly a result of a death of the children's parents, or a surviving parent moving out in search for employment to provide for children. This study has shown child only households not only rare, but decreasing over time, and also characterised by high dissolution rates. Ntozi and Mukiza-Gapere (1995) attribute the dissolution of these households to friends and relatives fostering these children by absorbing them into their households. In agreement to this, the GPC (in section 3.8) also shows the most common reason of child movement attributed to the children joining relatives or fostering. However, for those that remain inexistent, this can be attributed to the friends and relatives supporting the child(ren) as they continue to reside in their own households.

Middle-aged adults are observed to be characterised by frequent movement mainly attributed to employment, joining other relatives, or marriage (section 3.8) resulting in the household dissolving. Seeley (2013) mainly attributes adults joining other residents to the adults failing to cope on their own and commonly returning to their parental home. In marriage, it is most common for the woman to join the man than vice versa (as observed by Mtika and Doctor (2002) and Seeley (2013)). The movement to work is however more common among the men, as also observed by Barratt et al. (2012).

In addition to being most likely to die, the elderly are also commonly observed to live with other relatives for support due to old age or in response to famine or drought (commonly to live with his/her child) or to offer support to others for example support a child in taking care of the grandchildren as their parent goes to work.

However, households with a child and only a middle-aged man or middle-aged woman resident dissolve as they are absorbed into existing households or only the children are relocated as the middle-aged adult moves elsewhere usually for employment opportunities. This tendency to dissolve was however reduced if both a middle-aged man and woman were co-resident with at least a child.

The household composition categories described as being most likely to dissolve are also characterised as being small households. This is in agreement with the hypothesis that the larger the household, the least likely it is to dissolve. In addition, households with a middle-aged household head were least likely to dissolve if the household had at least an older adult resident, while those headed by an older adult were most likely to dissolve if there was neither a child nor middle-aged adult resident. This shows the household stability resulting from the support of an older adult or the existence of dependents that give reason for the continuation of the household with hard work from the young residents or support from relatives and the community.

3.9.1.1 Comparison to the hypothesis

I had hypothesised high dissolution rates in households with only a middle-aged women resident; or those with only older adult residents with no middle-aged adult. My findings agree with the hypotheses attributed to young women's relocation in marriage, into a relative's home for support or for work. In addition to the death of the elderly, dissolution in households with an older adult with no middle-aged adult are attributed to the relocation to other households or other areas to live with relatives or in response to famine or drought.

The low dissolution rates in households with: a young man and young woman resident or at least a child, young adult and older adult resident, associates household survival with marriage, and the residency of a child and older adult. However, households with an older household head are associated with low dissolution rates if at least a middle-aged adult is resident.

3.9.2 Household migration

Household composition was found to be associated with the migration of households with the households most likely to migrate having:

- only children or middle-aged adults in the household;
- a child and only a middle-aged man or middle-aged woman (not both) and no older adult resident.

Migration of children can be attributed to the children relocating to areas where they can receive support from relatives or friends nearby. The migration of middle-aged adults can be attributed to employment opportunities common in households where there is no child resident or in those where only a middle-aged man or middle-aged woman is resident.

3.9.2.1 Comparison to the hypothesis

I had hypothesised high migration rates in household with only middle-aged adults resident or those headed by an unmarried man and low migration rates in households with at least an older adult resident or a middle-aged woman living with at least one child resident. My findings agreed with these hypotheses attributing the high migration rates to the frequent movement of young adults and low rates in households with at least an older adult resident or those with a child living together with both a middle-aged man and woman.

3.9.3 Changes in household composition over time

Most of the household dynamics could be attributed to movement among the middle-aged adults. Therefore to best illustrate the composition change, let's look at the households with and those without a middle-aged adult resident.

3.9.3.1 Households with a middle-aged adult resident

Households with at least a middle-aged adult resident either have:

- no child resident,
- a child and either a middle-aged man or middle-aged woman; or
- a child, and both middle-aged man and woman.

The households with no child resident were most likely to experience a child joining the household mainly through the birth of children or children being fostered into the household (Section 3.8). Those with a child living with a middle-aged man with no middle-aged woman either experienced the relocation of the children or a joining of a middle-aged woman. The relocation of the children could be attributed to male adult failing to take care of the child thus relocating them with other relatives. A middle-aged woman joining a household could be attributed to the marriage of the man or to a woman relative joining to help support the children. Unlike the middle-aged men, a middle-aged woman living with children with no resident middle-aged man tended to stay with their children with lower cases of relocation of children. Instead, either the households maintained this composition, or a middle-aged man joined the household. Chirwa et al. (2004) reminds us of the cultural aspect also shared by the GPC setting where in marriage, it is the woman that joins the man. Therefore in this case, the man joining the woman in marriage could be attributed to a returning husband. An inclusion of the middle-aged man could also be attributed to the growth of a child resident to an adult.

Not much change was observed in households with a child living with a middle-aged man and middle-aged woman but an older adult joining the household is observed in some instances. Section 3.8 attributed older adult movement to either seeking support (in old age, ill health or in seasons of famine or drought) or providing support for example after the birth of a child. Also observed is the middle-aged woman leaving the household which could be attributed to the the divorce or separation where the woman leaves the household. However Chirwa et al. (2004) observed a common tendency of women leaving with their children.

3.9.3.2 Households with no middle-aged adult resident

Households with no middle-aged adult either have only older adult residents or a child living with an older adult. The change in the composition is mainly attributed to the movement of the children. Children joining the household could be attributed to the older adults fostering their grandchildren after the death of their parents or the relocation of the children by their parents as they seek employment elsewhere. Alternatively, the children leave to re-join their parents or for school.

3.9.4 Comparison with other studies

The scarcity of longitudinal studies investigating whether there is an association between a household's composition and the household's survival or observing the changes in a household's composition over time makes comparing the findings of this chapter with other studies difficult. A longitudinal investigation of changes in household composition in Uganda was done by Ntozi and Zirimenya (1999), however, they investigated households that have experienced a death. This differs from the study setting of this thesis which looks at all the households in the study area irrespective of death experience. However since a death in the household is recorded in the GPC data collection, this aspect is handled in Chapter 5 and will enable the comparison of the GPC findings and the work by Ntozi and Zirimenya (1999). Alternatively, the GPC findings can be compared with the work done by Chirwa et al. (2004) who observed household dynamics in Malawi in the 1980s specifically looking at the aspects of household size and the age and sex of the household head. Firstly, Chirwa et al. (2004) observed a higher survival rate in households headed by men than in those headed by women. My findings in this chapter agree with this finding but, also emphasises that the survival is higher if the male household head is living with his spouse in the same household and is either: middle-aged living also with a child; or an older adult living with at least a child and middle-aged adult. However, households headed by a man not living with his spouse (either having only older adult residents, only middle-aged adult residents or a child living with a middle-aged man) were likely to dissolve or migrate.

Chirwa et al (2004) also observed high household survival rates among households headed by an older woman. My findings also agreed with this, but go further to emphasise that these female household heads are usually unmarried, separated or widowed, and the high survival rate is experienced when there is at least a child and middle-aged adult resident. The absence of these increased the chances of the household dissolving. Alternatively, Chirwa et al (2004) observed households headed by young women as unstable, a finding also observed in the GPC households where the women were commonly unmarried, divorced or widowed with at least a child resident. As observed at the start of this section, households of this composition were likely to migrate as well as dissolve.

And finally, Chirwa et al (2004) found small households unstable and likely to be absorbed into other households. My findings agreed with this finding by showing high dissolution rates among the small-sized households. However, high migration in the small-sized households was specifically common in those with no older adult resident.

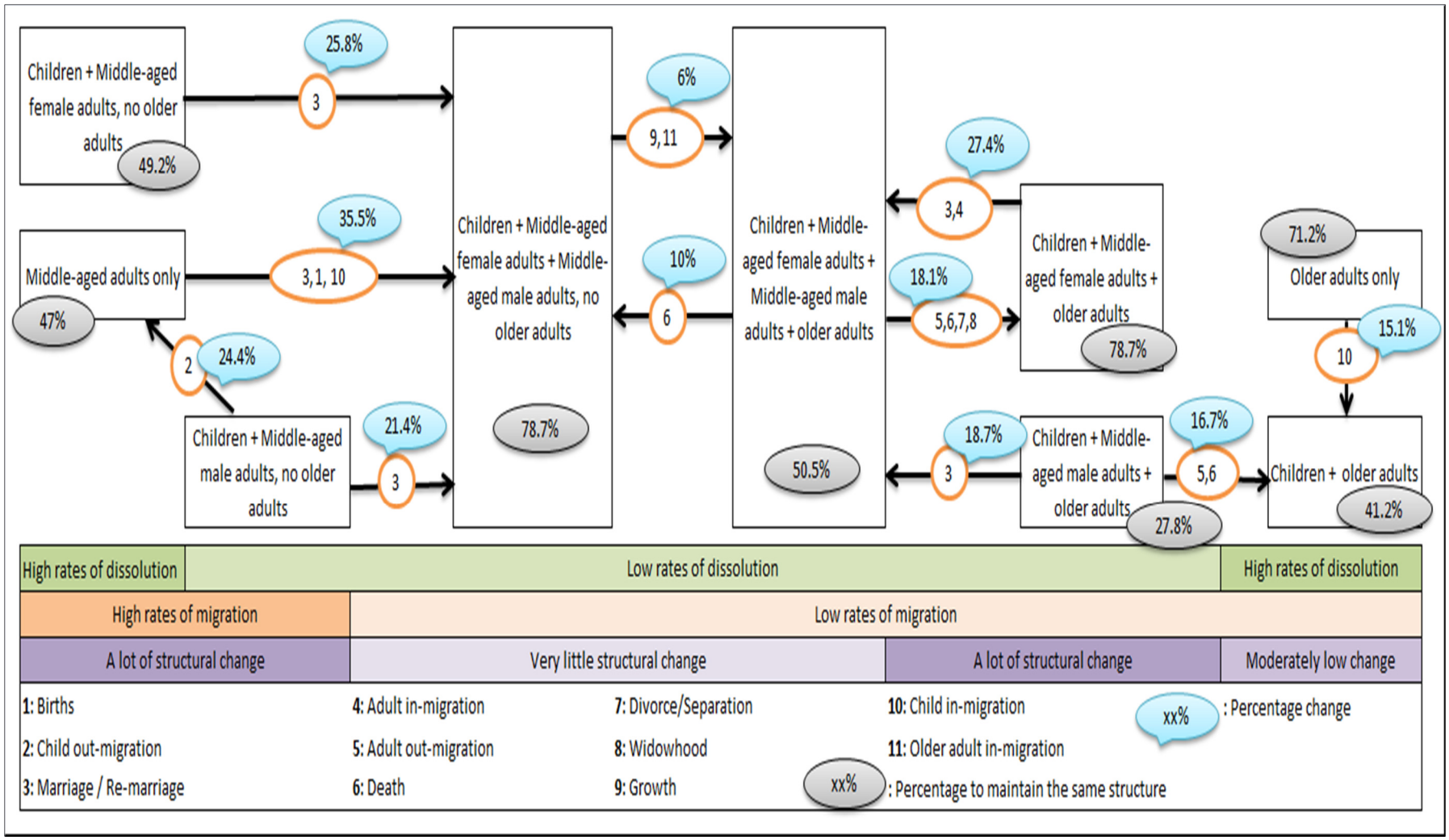

Figure 26: Common household dynamics by household composition structure with the events and transitional percentages superimposed

3.9.5 Conclusion

The aim of this chapter was to provide an insight into the dynamics of households in a sub-Saharan setting by undertaking a univariate analysis relating the household compositional structure to the household dynamics. The least tendencies of dissolution or movement by households were observed among those with a child living with both a middle-aged man and woman; or those with a child, middle-aged adult and older adult. The 'unstable' households, however, were commonly observed changing to 'stable' compositions mainly by having an addition of children or middle-aged adults to the household residency. Movement of women was mainly attributed to marriage while among men movement was for work or to be absorbed into a household after failure to self-sustain, and in-movement of children mainly corresponded to births or fostering. Households with no older adult and no: middle-aged man, middle-aged woman or no child tended to frequently move from one place to another. Finally, the movement of older adults was mainly attributed to death which had a minimal short-term impact on a household with a middle-aged adult resident. However, with no middle-aged adult the remaining residents after the movement of the older adults, usually children, were fostered in other households.

These household tendencies could change in relation to other household experiences such as resident ill health or death. It is these aspects that are to covered in Chapter 5. Chapter 5 builds on the findings of this chapter by undertaking a multivariate investigation that includes the aspects of household experience of resident HIV infection and mortality on the household behaviour taking into consideration the household's socio-economic status.

4 DESCRIBING THE FAMILY STRUCTURE OF HOUSEHOLDS

4.1 Introduction

In the study of household dynamics, researchers have commonly looked at the composition of households as illustrated in Chapter 3. However, concept of family relationships in the household was also put into consideration if a better understanding of household dynamics is to be achieved. For example, in the study of HIV infection and AIDS, knowledge of family relationships in the households can enable the observation of the effect of the infection. This is mainly because the infection usually affects family members more severely than any other household member. The knowledge of family relationships also enabled the identification of any separation among immediate family such as children being fostered out, divorce/separation (Timæus (2006e)).

In investigations involving family relationships within households, the households are usually grouped into categories grouping together those with family relational characteristics that react similarly to life-changing events (for example HIV infection, AIDS illness and death of family members). Researchers have observed these household reactions using family life cycles that show the expected stages of households (in regards to the family relationships among the household members) over time and observing how these stages are altered by particular events.

This chapter therefore starts by defining and grouping households into categories (referred to in this chapter as the family structure). These categories encompass family relationships of interest to the investigation in regards to the effect of adult HIV infection and mortality on family relationships in the households. The distribution of the GPC households in these categories over time (between 1989 and 2008) is determined and the association of the categories to survival of the households (particularly household dissolution or household movement outside the study settings, referred to as household migration in this thesis) investigated. Further, changes in the household categories over time are determined and a family life cycle of the GPC households generated. These findings will also be referred to in

Chapter 5 when the aspects of HIV infection and mortality are incorporated in the investigation to determine how these events alter the overall dynamics of the households. This chapter therefore aims at providing answers to the following research questions:

- What is the distribution of the GPC households?
    - Which family structure is most common?
    - Which family structure is least common?
- Is there an association between a household's family structure and its dissolution and migration? If yes:
    - Which household structures are most likely to dissolve or migrate?
    - Which household structures are least likely to dissolve or migrate?
- What are the patterns of structural change in household family structure over time?
- What could be the reasons for these household changes?

4.2 Using family relationships within the household to describe the household

Before grouping the households into categories that identify them by the family relationships among the household members, one must first understand how researchers have used different family relationships to describe households. A detailed illustration of family relationships describing households was presented by Hammel and Laslett (1974) who despite describing household in Europe provide a good background to describing households by their family relationships irrespective of their location. Hammel and Laslett (1974) start by defining the conjugal family unit (CFU) describing at least two individuals connected by a conjugal link living together, commonly comprising of a husband and wife living together with their unmarried children. A man living with his children or a woman living with her children also constitute a CFU. However they argue that despite a widow and her child constituting a CFU, a solitary widow or a widow with a grandchild does not.

Furthermore a CFU living on its own is counted as a simple family household (SFH). The expression 'simple family' here covers what is variously referred to elsewhere as the nuclear family (Goodenough, 1970, Ankrah, 1993, Mathambo and Gibbs, 2009), the elementary family (Goodenough, 1970, Yanagisako, 1979, Ankrah, 1993), and the conjugal family (Goodenough, 1970, Yanagisako, 1979, Timæus, 2006b). A SFH is not necessarily confined to the CFU; for example, servants, workers, visitors, boarders and lodgers with no kinship relationship can also be counted as household members. A household can also be less than a CFU; for example a widow living alone does not constitute a CFU, but is counted as a household. A polygamous family household is described by Timæus (2006d) as a man living with more than one spouse in the same household and this can be categorised under a SFH.

However, when a CFU also includes another relative other than the child it is referred to as an extended family household (EFH). In other words, an EFH consists of a CFU with the addition of one or more relatives other than offspring, no combination of which constitutes a CFU in itself (this is irrespective of the co-residency of workers). Households can be extended vertically and/or laterally. The addition of a relative from a generation earlier than that of the principal household member (referred to as the household's head), for example, the married head's father, adds an upwards vertical extension; while the presence of a grandchild (without either parent, either fostered or orphaned) creates a downward vertical extension; and brothers, sisters and cousins of the household head or his spouse create a lateral extension. Households can be extended both vertically and laterally at the same time.

However, the existence of both the father and the brother of the head does not give rise to a combination of vertical and lateral extensions but to multiplicity, as together the head's father and brother themselves make up a CFU, creating a multiple family household (MFH). In other words, the MFH constitutes two or more CFUs connected by kinship or marriage for example, a married head and his spouse living with his brother and his spouse or with a widowed sister and her offspring. The widowed sister and her offspring could be termed a 'fragmented' household, describing a single parent who is not the household head co-residing in the household with her offspring. Each of the CFUs in an MFH can itself be simple or extended. MFHs are also widely referred to as 'joint families' (Ankrah, 1993, Timæus,

2006d). Kinship among the servants in the household does not create an MFH. If the secondary CFU (which does not contain the head of the whole MFH) is of an earlier generation than the head, for example, the head's father and mother, this is referred to as the household being 'disposed up'. If the head's married son and his spouse and perhaps also their offspring are included in an MFH it is 'disposed down'. An MFH can also be 'disposed laterally', for example when married brothers or sisters live together in an overall arrangement that social anthropologists refer to as the fraternal joint family. If a laterally-disposed MFH includes, for example, a widowed parent of the married siblings, the household is both laterally disposed and upwardly extended. Finally, Hammel and Laslett (1974) refer to a MFH that does not include anybody of a generation earlier than the head's, for example, a household including the head's married brother and perhaps an unmarried brother as 'frérèche'.

These different household descriptions of the family relationships among the residents are summarised in Table 22. To include the concept of the generational frame work, these categories are further summarised as shown in Figure 27. For example a household can have a:

- 1-generation family structure, represented by N or Lat (a);
- 2-generation family structure: for example N**+**L1(a), which is the most common nuclear family structure, with a household head, spouse and offspring;
- 3-generation family structure: for example N**+**L1(a)**+** L2(a) or simply N+L1(b) representing a household head, spouse, offspring and grandchild; or N+L1(a) +U1(a) representing a household head, spouse, child and parent;
- multi-generational family structure: for example N+L1(b)+U1(a) representing a household head, spouse, offspring, grandchild and parent(s) of the head;
- Skip-generational family structure, in which a generation is skipped; for example N+L2 representing a household head, spouse and grandchild, with the generation of the head's offspring missing.

I, however, include the aspect of children residing in a household with neither one or both of their parents (with the resident parent not the head of the household) using the term 'fostered' if neither parent is resident or 'fragmented' if one parent is resident.

Table 22: Summary of the household family structural types, as illustrated by Hammel and Laslett (1974)

Simple family households (SFH)
Married couples alone
Married recently - no children yet
Married long enough for the children to have left the household
Married couples with child(ren)
Widowers with child(ren)
Widows with child(ren)
Extended family households (EFH)
Extended upwards
Extended downwards
Presence of grandchildren with no parent resident
Nieces and nephews residing without parents
Extended laterally
Multiple family households (MFH)
Secondary units UP
Secondary units DOWN
Secondary units lateral
frérèche

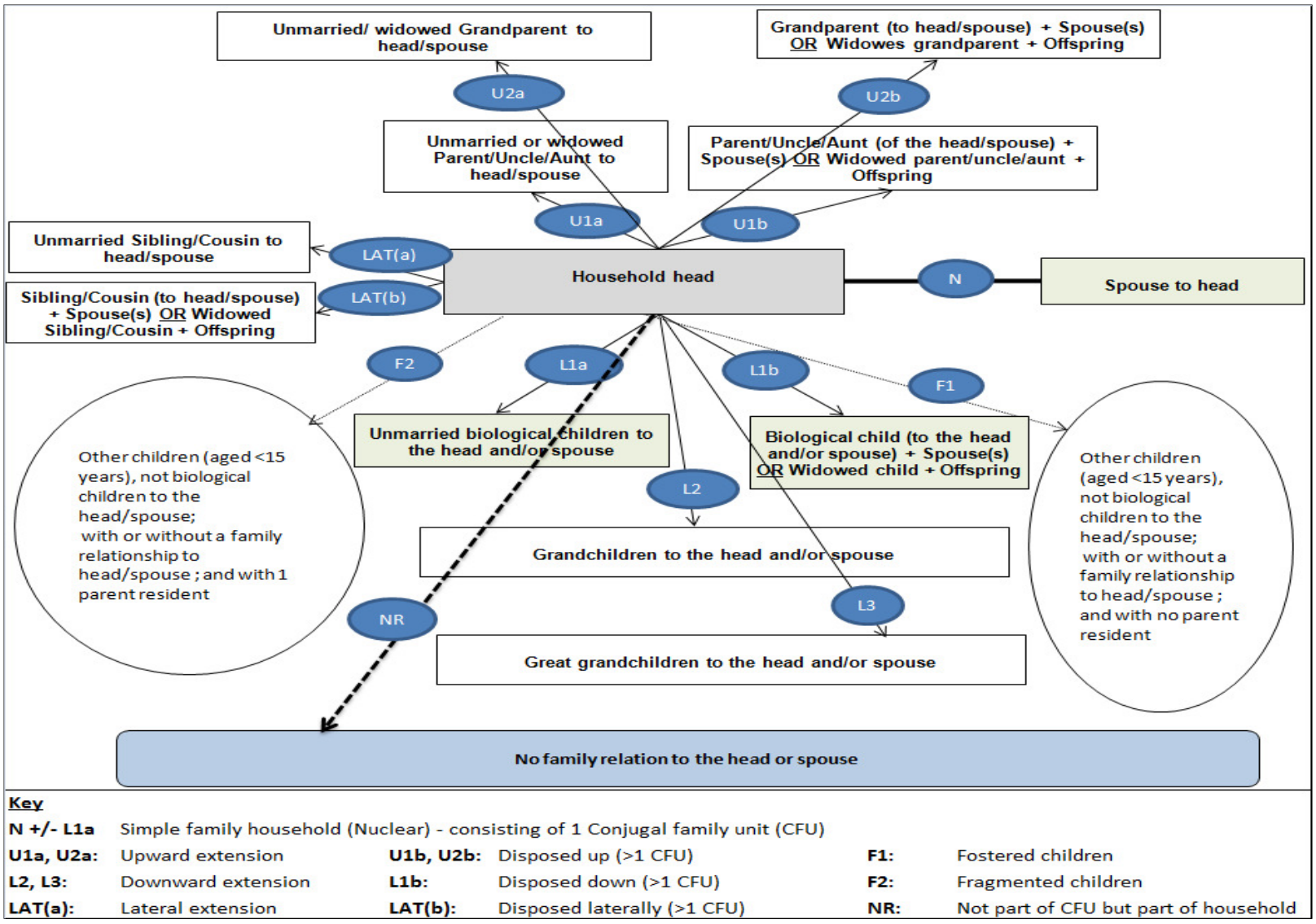

Figure 27: Family household structures

4.3 Determining a household family structure categorisation

Drawing from the different descriptions of family relationships presented in section 4.2, several researchers, including Hammel and Laslett (1974), have summarised these descriptions into household categorisations combining the characteristics of research interest (White and Tsui, 1986, Richards et al., 1987, Gilbertson and Gurak, 1992, Hunter and Ensminger, 1992, Seeley et al., 1995, Ntozi and Zirimenya, 1999, Mathambo and Gibbs, 2008). For example, the research interests of Mathambo and Gibbs (2008) were based on identifying the households with the highest probability of being affected by deaths resulting from AIDS with a major focus on orphan-hood. This therefore led to the inclusion of:

1. single-parent households in which the household head is a widow or widower;
2. child-headed households in which the household head is under 18 years;
3. 'missing generation' households which include at least one orphaned child who is a grandchild of the household head.

In Uganda, in the study of household coping strategies using the GPC households, Seeley (1993) categorised the households as shown in Table 23 to determine the socio-economic impact of AIDS on rural Ugandans and to describe how individuals and households cope with the epidemic. Wittenberg and Collinson (2007) have a more elaborate classification as shown in Table 24. They designed this classification to investigate changes in household structure in rural South Africa over the period 1996–2003, a period marked by politico-structural change and an escalating HIV/AIDS epidemic.

Table 23: Household classification by Seeley (1993)

1. Monogomous (married couple), no children
2. Monogomous (married couple), with children
3. Polygamous - man with multiple spouses (with or without children)
4. Extended (three generations)
5. Remnant male (man and children or other relatives but no wife)
6. Remnant female (woman and children or other relatives but no husband)
7. Single male
8. Single female

Table 24: Household classification by Wittenburg and Collinson (2007)

1. Single-person households.
2. Couples – defined as a head plus spouse.
3. Nuclear households – defined as a head plus spouse plus biological children.
4. Single parent households – defined as a head plus biological children.
5. Three-generation linear households – defined as a head (with or without spouse) plus biological children plus parent (or parent-in-law); or a head (with or without spouse) plus biological children plus biological grandchildren.
6. Three-generation skip households – defined as a head (with or without spouse) plus biological grandchildren, but with no biological children present.
7. Multi-generation households – defined as households with great-grand parents and/or biological great-grand children.
8. Sibling only households – defined as a head with his/her siblings.
9. Complex but related households – households that do not fit any of the previous categories, but in which everyone is related (directly or inlaw) to the head of the household.
10. Complex plus unrelated – households in which at least one member of the household is not related to the head.

4.3.1 The skip-generation structure

One aspect of common interest to researchers especially in AIDS research is the skip-generation structure which are households composed solely of older adults (aged 50 or 60 and over) and children (aged 15 and under) with no adults of prime age (commonly aged

between 15 and 50 years or between 15 and 59 years). This is assumed to project an image of a grandparent (commonly a grandmother) living with grandchildren whose parents have died, commonly due to AIDS, or are working elsewhere(Hosegood, 2008). Madhavan and Schatz (2007) simply define these households as those with no residents between the ages of 15 and 59 years. With the growth of HIV infection and AIDS deaths among prime-age adults, the number of households of this structure has been expected to increase. However, investigations have not found this to be the case (Bicego et al., 2003, Madhavan and Schatz, 2007).

In fact analyses of the South African census and demographic health survey data showed less than 2% of the households having this structure (Noumbissi and Zuberi, 2001, Merli and Palloni, 2004). Ntozi and Zirimenya (1999) found the prevalence of such households in Uganda less than 1% in 1992 and 1.6% in 1995. To explain why an increase of households with this structure is not actually being observed, Hosegood and Timæus (2005) found such households prone to dissolution or change in structure as young adults join or the children leave the household. Specifically since most of the investigations focus on a single point in time, the observation of the increase in the households of this structure is hindered by the frequent dissolution or change in structure.

4.3.2 Single-parent and child/sibling only households

In the early 1990s, Ntozi and Mukiza-Gapere (1995) observed the emergence of a new household structure in Uganda where households are headed by widows, single women, children under 18 years of age and orphans. The emergence of the widow-headed households could be attributed to the gradual disappearance of the african traditional practice of widow inheritance by brothers-in-law for fear of contracting HIV. There is also an increase in orphans in communities, whose care is causing heavy burdens, leading to the orphans staying in their homes with some or no external assistance from neighbours and relatives.

4.3.3 Single-person household

Another structure known to be unstable and likely to dissolve is the single-person household, as a result of commonly being absorbed into other households (Foster et al., 1997, Urassa et al., 1997, Zulu and Sibanda, 2000, Nakiyingi et al., 2001). In northern Malawi (Karonga) only 4.2% of the single-person households remained as distinct entities between two time points five years apart in the 1980s (Chirwa et al., 2004).

4.3.4 Male-headed versus female-headed households

Handa (1994) finds that female- and male-headed households tend to be different types of households. A male-headed household frequently implies a married couple, while a female-headed household more frequently represents a single or unpartnered woman.

4.3.5 Changes in family structure

After categorising the households appropriately, another area of interest would be to observe the changes in the family relationships in the household over time an investigation that some researchers have termed as the generation of the household's family life cycle (FLC). The categorisation groups together households that react similarly to the consequences of life-changing events such as marriage or remarriage, divorce or separation, reproduction (births), illness (including HIV infection and AIDS), death, and child and adult movement in or out of the household (Gilly and Enis, 1982). Then the observation of a household's category from one time point to next identifies the changes in the household's categories as well as the corresponding life-changing events and processes such as births, growth, decay and dissolution over time.

With most household categories more or less based on the age and marital status of the adult household members and the presence and age of the children (Hawkins et al., 2001), the changes in the households (or the FLC model) were originally synthesised into five basic stages of household change (Schiffman and Lazar, 1997):

- Stage 1: Bachelorhood - young single adult living apart from parents

- Stage 2: Honeymooners - young married couple
- Stage 3: Parenthood - married couple with at least one child living at home
    - Full nest I: Youngest child under six
    - Full nest II: Youngest child six or over
    - Full nest III: Older couples with dependent children
- Stage 4: Post-parenthood - an older married couple with no children living at home
    - Empty nest I: Older couples, no children living with them, head in labor force
    - Empty nest II: Older couples, no children living at home, head retired
- Stage 5: Dissolution - one surviving spouse
    - Solitary survivor in labour force
    - Solitary survivor, retired

However, Gilly and Enis (1982) redefined the FLC to account for the increasing number of single-person households, cohabitation by non-legally married adults, delayed parenting, and rising divorce rates.

A good illustration of a FLC model that focuses on households in sub-Saharan Africa was presented by Hosegood et al. (2008) reviewing the demographic impact of HIV and AIDS on households in reference to the household's characteristics. The FLC by Hosegood et al. (2008) identified three key stages of the FLC model: the foundation, building and dissolution stages (as shown in the schematic diagram in Figure 28). Similar to the observations by Gilly and Enis (1982), these stages are reported as resulting from life-changing events or processes such as marriage, family formation, births, household building, death and household dissolution; also identifying union formation and dissolution as the key demographic events (Imhoff et al., 1995, Meekers and Calvès, 1997).

In this FLC model, the forming and building of households is commonly linked to marriage and childbearing. The timing and patterns of formation and building of the households are thus largely dependent on marriage and marital fertility. Thereafter, the specific forms and pathways the household follows are dependent on the influence of social, cultural, demographic and economic processes of the population.

Widowhood or separation/divorce creates households headed by an unmarried head with or without children. As the family gets older, either an extended household is created as grandchildren are born or relocated into the household, or the household experiences an exit of the adult children leaving the older parents alone with their younger children, or with grandchildren. The risk of dissolution is thereby predicted in households with a widowed or divorced older person. However, this FLC model does not represent the course of multiple households linked to polygamous men, the creation of extended households or other ways in which the headship of extended households may change and the households continue to build following the death of their founding head. Since the major focus for the review by Hosegood et al. (2008) was to actually look at the demographic impact of HIV and AIDS, the aspects of HIV infection and AIDS were represented within the FLC model. This model will therefore be also referred to in Chapter 5 when the aspects of HIV infection and mortality are discussed.

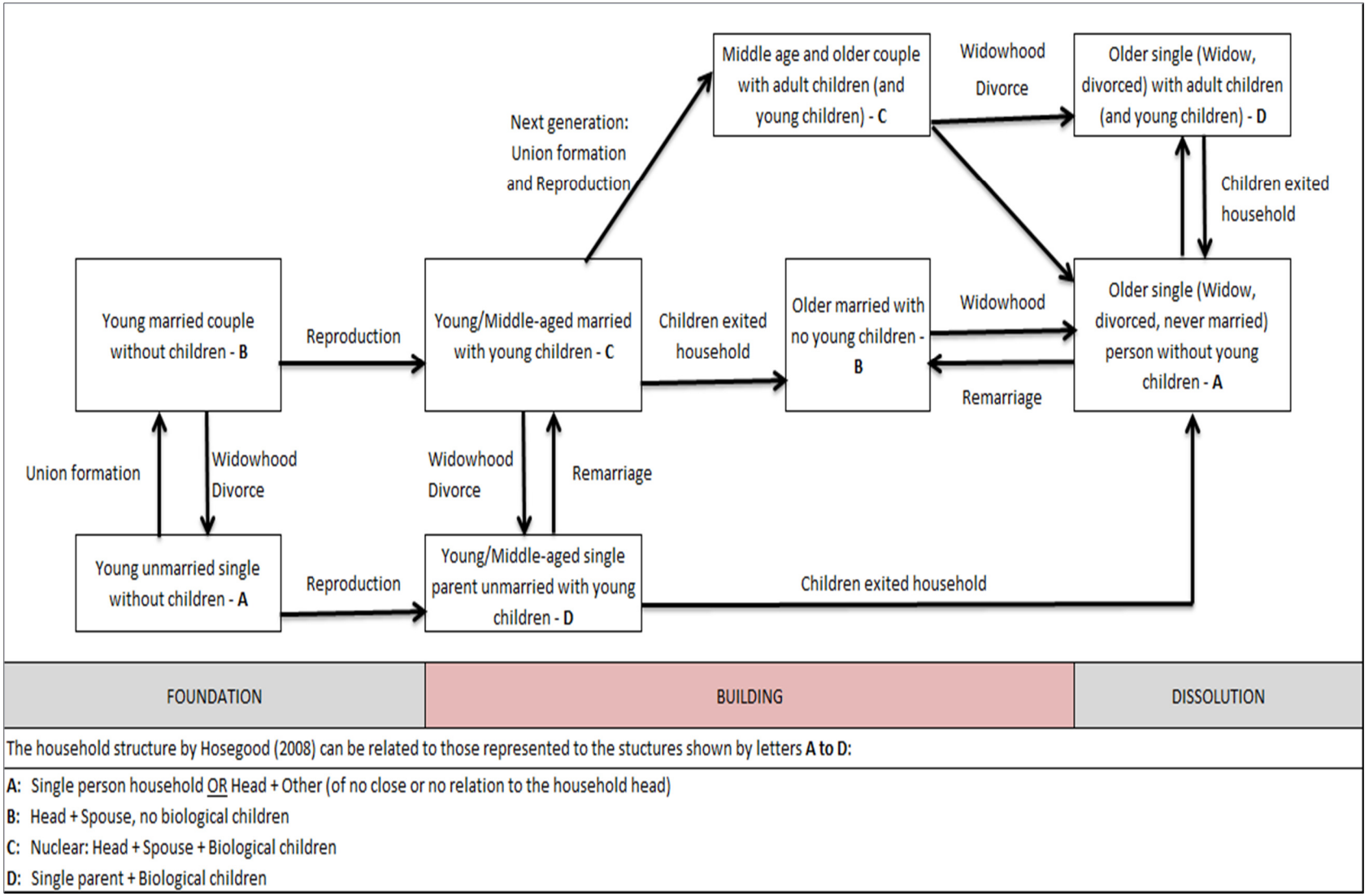

Figure 28: A schematic diagram by Hosegood et al. (2008) illustrating household family structural change over time

4.3.6 The choice of family relationship characteristics of interest

Since the ultimate investigation will be to observe the impact of HIV infection on the change in household family relationships, I am guided by relationships of interest to researchers looking at aspects of HIV infection and AIDS to identify the relationships of interest and thus the household categories (or groupings). This is coupled with the consideration of the key stages and processes of household FLC model presented by Hosegood et al. (2008) in the investigation of the impact of HIV infection and AIDS on households. These categories are then used in the univariate analyses covered in this chapter and later in the multivariate analysis in Chapter 5 when the aspect of adult HIV infection and adult mortality is introduced.

The family relationships of research interest in this thesis are therefore:

- single person residency
- the marital status, age and sex of the household head
- the residency of the offspring of the household head or spouse of the head
- more than two generations living together thus identifying the extended households as well as the distinct identification of skip-generation households
- the co-residency of unmarried individuals with a kinship relationship specifically identifying siblings living together.

The household categories (referred to as the household's family structure typology) are constructed as shown in Table 25. Note that all classifications presented in Table 25, with the obvious exception of the single-person household, can include household members of no kinship relationship to the household head. The typology, however, does not distinctly include the aspects of lateral extension, multiple-family households and the child characteristics that describe fragmentation and fostering as these were not part of my study interests. However, lateral extension is partially represented in households with unmarried siblings, fostering is partially represented in skip-generation structures, and fragmentation is partially represented in the description of the extended households.

Table 25: The household family structure classification developed for analysis

Single person household: male
Single person household: female
Head + spouse(s), no biological children
Nuclear: head + spouse(s) + biological children
Single parent: male head + biological children
Single parent: female head + biological children
>2-generational household: upward extended
>2-generational household: downward +/- upward extended
Head + parent, no biological children
Skip-generational household: downward +/- upward vertical extended
Sibling only
Head +/- others[1]

[1] Household members with (and/or without) a kinship relationship not classified above

4.4 Research hypotheses

Guided by the findings or observations made by authors looking at family relationships (as presented in section 4.3) the following research hypotheses are predicted:

1. The most common households have a married couple with or without biological children resident in the household
2. There is an increasing trend over time of households with:
    a. a single parent living with biological children
    b. a skip generation structure
    c. only the residents siblings
3. High dissolution rates are associated with households with:
    a. a single female resident or female sibling only residents
    b. an older single person resident or older married couple with no children resident

4. High migration rates are associated with households with:
    a. a single young man resident
    b. a young married couple with no children
5. Low dissolution and migration rates are associated with households with:
    a. 'Nuclear family' households
    b. 'Extended family' households
    c. an unmarried female parent living with her children
6. 'Nuclear family' households are likely to retain this structure over the medium-term (e.g. 5 years) but there will be some evolution to single-parent households, to households without children, and to "extended family" households
7. 'Extended family' households are likely to experience more change in their composition than 'nuclear' or smaller households, as a consequence of more "fluid" household membership
8. Single man parent households are likely to evolve to single person or nuclear structure
9. Single woman parent households are likely to retain their structure over the medium term (4 to 5 years)

These hypotheses are also graphically presented in Figure 29 showing the hypothesised changes in the household family relationships, those most likely to dissolve or migrate and the possible reasons for the predictions made. To therefore test these hypotheses, both cross-sectional and longitudinal analyses are undertaken.

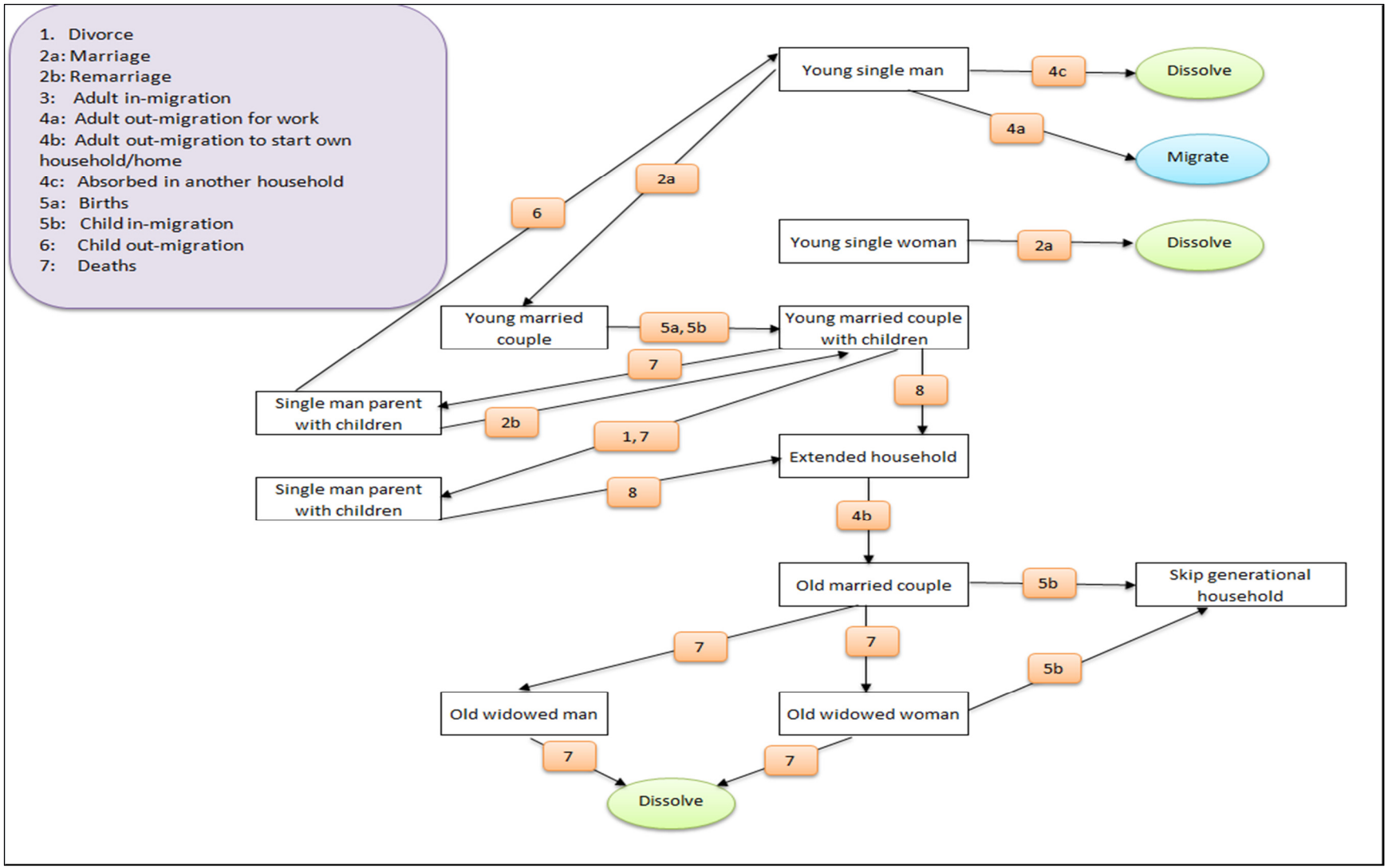

Figure 29: Graphical presentation of the research hypotheses observing family relationships in a household

4.5 Cross-sectional investigation of the distribution of GPC households by their family relationships

The cross-sectional observation of the distribution of the GPC households by their family structure is presented in Figure 30, Figure 32, and Appendix 8.8. Although not much change in the distribution was observed over the survey periods is observed in Figure 30, most of the GPC households had a 'nuclear' structure where a married couple is living together with their biological children (average annual prevalence of 38% of households) and the '>2-generational household: downward +/- upward extended' structure (average annual prevalence of 16%, with those only 0.9% upward extended leading to a total of 17%). Households with a 'head + parent, no biological children' (0.2%) or 'sibling-only' (1.6%) structure were rare. In addition, an average across the survey periods showed 10% having a skip-generational structure; 13% as single person households and 11% with a male resident and 3% with a female resident.

A critical look at the distribution of the categorisations individually in Figure 31, shows some increase in single person households over time. With not much change in the distribution of households with a married couple with children, those with no children were observed to be decreasing with time. Similarly, not much change was observed among the households with a single male parent, but there was an increase in those with a single female parent. For the extended households, an increase was recorded in those extended only upwards and a slight increase in those with a skip generational structure. Not much change was observed among those extended both upwards and downwards, and there was a decrease in those where a head lives with his/her parent. A fluctuating distribution is observed in the households where siblings are living together or where a head is living with persons with no family relationship.

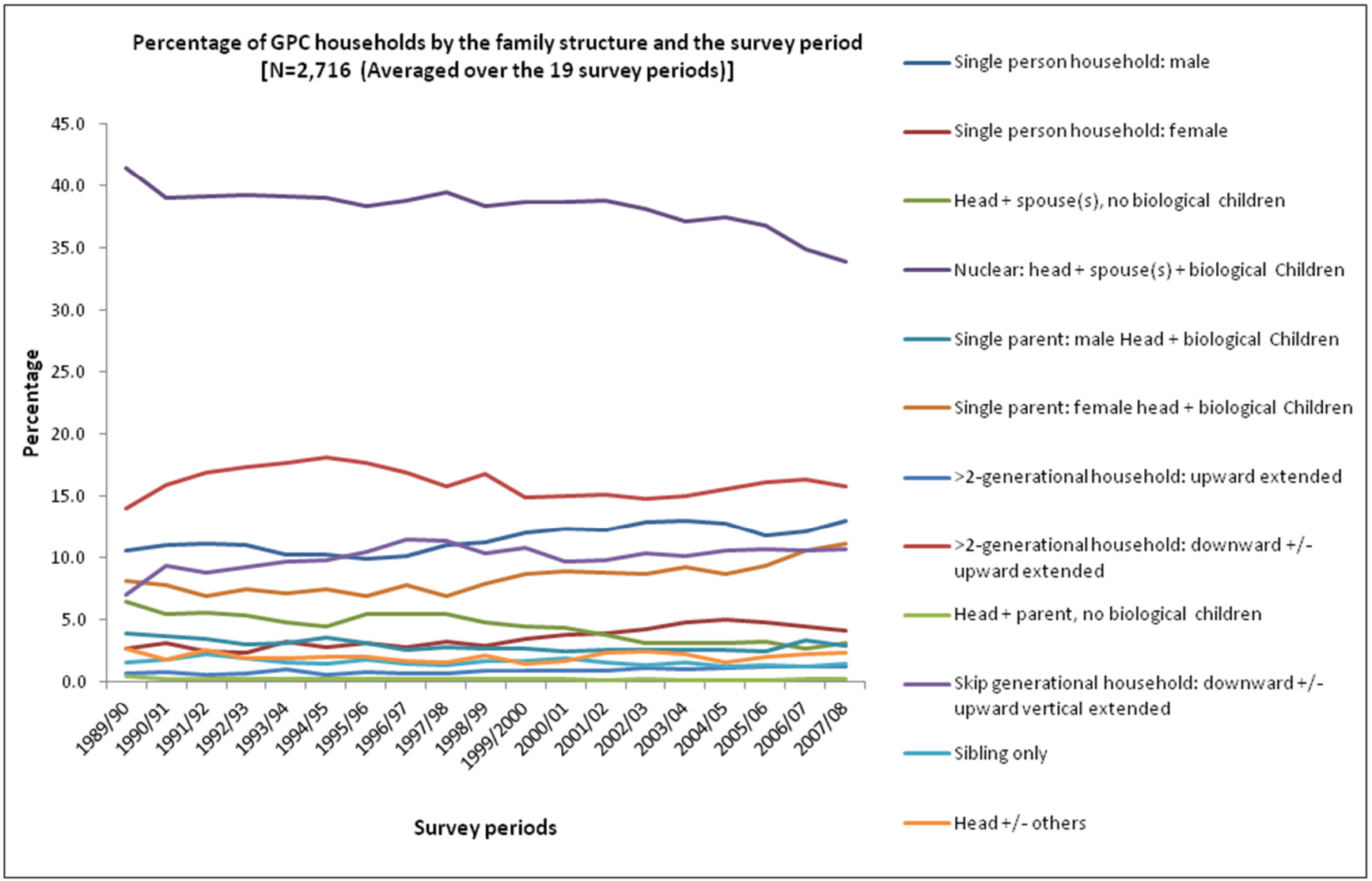

Figure 30: Percentage distribution of households by their family relationship categorisation for the 19 surveillance surveys

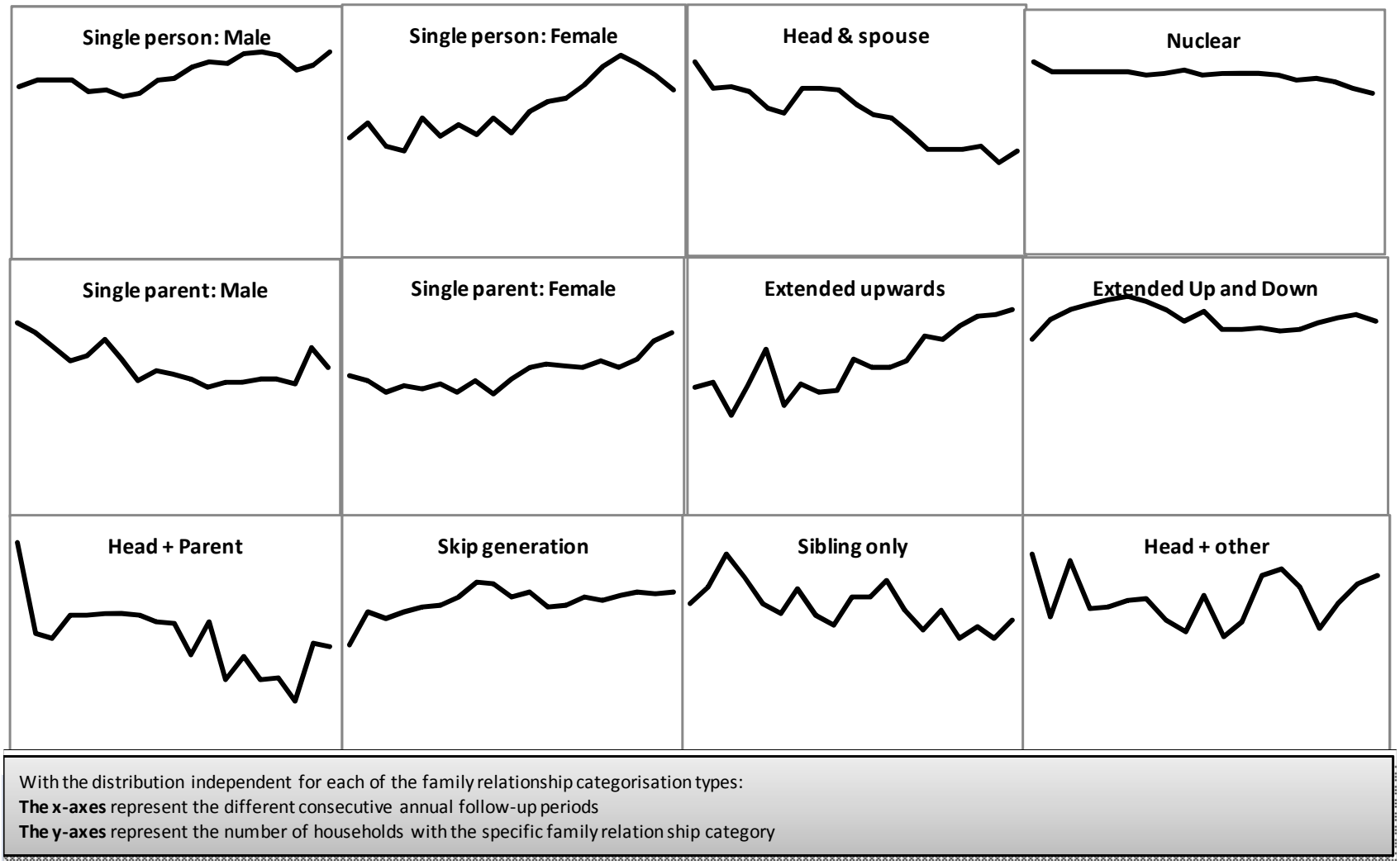

Figure 31: Further presentation of the distribution of households for each of the family relationship categorisation over the 19 surveillance surveys

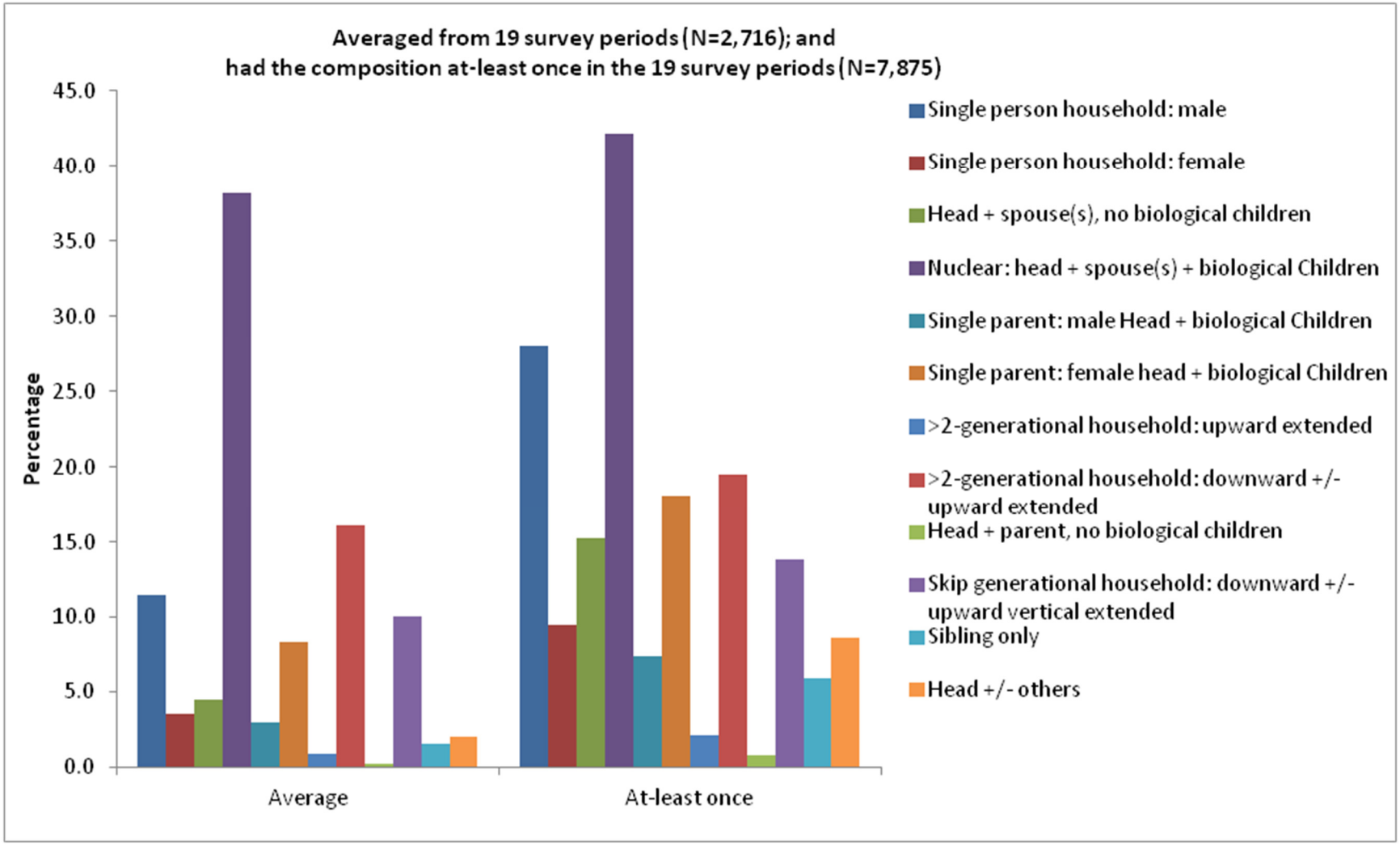

Figure 32: Summarised distribution of households by their family relationship categorisation

Table 26: A percentage cross-sectional comparison of the family relationship categorisation structure and the household head characteristics of the GPC households between 1989 and 2008

Family structure	Household head characteristics											Overall percentage of 51,606 household entries over the 19 survey periods
	Resident spouse					Non-resident spouse						
	Male head			Female head		Male head			Female head			
	Child	Middle-aged adult	Older adult	Middle-aged adult	Older adult	Child	Middle-aged adult	Older adult	Child	Middle-aged adult	Older adult	
Single person household: Male	0.0	0.0	0.0	0.0	0.0	0.2	**81.8**	**18.0**	0.0	0.0	0.0	**11.8**
Single person household: Female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	**57.3**	**42.5**	3.7
Head + spouse(s), no biological children	0.1	**76.1**	**19.3**	4.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	4.2
Nuclear: Head + Spouse(s) + Biological Children	0.1	**91.2**	6.7	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**37.9**
Single parent: Male Head + Biological Children	0.0	0.0	0.0	0.0	0.0	0.0	**76.1**	**23.9**	0.0	0.0	0.0	2.9
Single parent: Female Head + Biological Children	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**94.1**	5.9	8.6
>2-generational household: Upward extended	0.0	**63.7**	2.9	1.6	0.0	0.0	11.2	0.0	0.0	**20.4**	0.2	0.9
>2-generational household: Downward +/- Upward extended	0.0	**24.4**	**29.6**	1.2	0.2	0.0	1.9	3.7	0.0	**23.6**	**15.5**	**15.9**
Head + Parent, No biological children	0.0	**11.8**	0.8	2.5	0.0	0.0	**54.6**	2.5	0.0	**21.0**	6.7	0.2
Skip generational household: Downward +/- Upward vertical extended	0.0	3.0	**20.2**	1.0	0.9	0.0	1.0	4.7	0.0	**20.6**	**48.6**	**10.1**
Sibling only	0.0	0.0	0.0	0.0	0.0	0.5	**67.4**	4.8	0.2	**19.3**	7.8	1.6
Head +/- others	0.0	0.0	0.0	0.0	0.0	0.2	**41.6**	5.2	0.1	**34.7**	**18.2**	2.1
Overall	0.0	42.6	10.2	1.2	0.1	0.0	14.4	4.1	0.0	17.3	10.0	100.0

A cross-sectional comparison of the family structure distribution to the household head characteristics (with a child head aged less than 15 years, middle-aged adult aged 15-59 years and older adult aged over 59 years) developed in section 3.5.3 shows single person households commonly with a middle-aged adult man (81.8%) or if it's a woman an even distribution between middle-aged and older women (57.3% and 42.5% respectively). Households with a resident spouse were commonly headed by a man (97.6% of the households with a resident spouse versus 40.4% of those without a resident spouse) while the extended households with no resident spouse were commonly headed by a woman (for example, for >2 generational households extended both upwards and downwards with a non-resident spouse, 87.4% are headed by a woman). Specifically, the skip generational households were commonly headed by an older adult (48.6% headed by an older woman with a non-resident spouse).

4.6 Longitudinal investigation of household non-survival (dissolution and migration) with reference to the household's family relationships

The longitudinal investigation of the household's non-survival by its family relationships undertaken in this sections entail the generation of household dissolution and household migration rates and rate ratios over the 18 longitudinal FPs (SFPs) and the 4 FPs (LFPs); the FPs described in section 1.4.3. The rates are generated per 100 HYRS in relation to each of the family structures and the rate ratios of each of the structures in reference to the structure with the least rate to enable the adjustment for the effect of survey period and village location. This identifies the family structures most or less likely to dissolve or migrate. I also incorporate the household head characteristics to identify whether the outcomes differ for the different household head characteristics within the family structure.

4.6.1 Household dissolution

The short-term and long-term rates and rate ratios of dissolution are presented in Table 27 and Table 28 (summarised in Table 29) while those by the household head characteristics are presented in Table 30. Single-person households were observed to have high rates of dissolution irrespective of the sex and age of the resident, but higher if the resident was an

older adult. Households with only sibling residents also had high dissolution rates with the rates higher if the head was an older adult and even higher if the older adult was a man.

Households with a single parent living with his or her child(ren) were more likely to dissolve if the parent was a woman. However, irrespective of the sex of the single parent, the household was least likely to dissolve if the single parent was an older adult.

The households with a married couple living with or without their biological children ('nuclear' and 'Head + spouse(s) with no biological children' respectively) had low rates of dissolution irrespective of the characteristics of the household head. However, irrespective of the extended households being less likely to dissolve, high rates of dissolution were observed among those whose household heads had no resident spouse. This was so if the head was middle-aged for the more than two generational households, or an older adult for the skip generational households.

4.6.2 Household migration

The short-term and long-term rates and rate ratios of migration are presented in Table 27 and Table 28 (summarised in Table 29) and by the household head characteristics in Table 30. The single person and sibling only households registered high rates of migration higher if the household head was middle-aged. Also registering high migration rates were the households with a married couple with no biological children while those with biological children registered lower migration rates, especially if the head was a man.

Table 27: Short-term rates and rate ratios of dissolution and migration stratified by the household's family structure

Family structure (Short term analysis)	Number of households	Household dissolution				Household migration			
		Dissolved	Rates[1]	Rate ratio[2]	p-value	Migrated	Rates[1]	Rate ratio[2]	p-value
Single person household: Male	2,035	343	**7.0**	**13.2**	< 0.001	730	**14.9**	**10.3**	< 0.001
Single person household: Female	699	134	**8.8**	**17.0**	< 0.001	199	**13.0**	**8.9**	< 0.001
Head + spouse(s), no biological children	1,127	27	1.4	2.5	< 0.001	169	**9.0**	**6.1**	< 0.001
Nuclear: Head + Spouse(s) + Biological Children	3,206	95	0.5	1.0	-	760	4.3	3.0	< 0.001
Single parent: Male Head + Biological Children	555	37	2.9	5.2	< 0.001	115	**9.0**	**6.2**	< 0.001
Single parent: Female Head + Biological Children	1,301	197	**5.4**	**10.3**	< 0.001	412	**11.3**	**7.8**	< 0.001
>2-generational household: Upward extended	156	7	1.6	3.2	0.003	17	4.0	2.8	< 0.001
>2-generational household: Downward +/- Upward	1,463	50	0.7	1.2	0.213	107	1.4	1.0	-
Head + Parent, No biological children	56	6	**6.1**	**10.6**	< 0.001	8	**8.1**	**5.6**	< 0.001
Skip generational household: Downward +/- Upward	1,040	152	3.3	6.2	< 0.001	141	3.0	2.1	< 0.001
Sibling only	435	48	**7.3**	**13.1**	< 0.001	117	**17.8**	**12.2**	< 0.001
Head +/- others	619	65	**7.8**	**14.4**	< 0.001	141	**17.0**	**11.6**	< 0.001

[1]: Rates per 100 household years (HYRS)

[2]: Rate ratio relative to the least rate and accounting for the village location and follow-up period

Table 28: Long-term rates and rate ratios of dissolution and migration stratified by the household's family structure

Family structure (Long term analysis)	Number of households	Household dissolution				Household migration			
		Dissolved	Rates[1]	Rate ratio[2]	p-value	Migrated	Rates[1]	Rate ratio[2]	p-value
Single person household: Male	1,002	204	**5.4**	**10.2**	< 0.001	384	**10.2**	**8.2**	< 0.001
Single person household: Female	312	84	**7.4**	**14.1**	< 0.001	90	**7.9**	**6.2**	< 0.001
Head + spouse(s), no biological children	416	25	1.4	2.5	< 0.001	97	**5.6**	**4.5**	< 0.001
Nuclear: Head + Spouse(s) + Biological Children	2,378	88	0.5	1.0	-	547	3.4	2.7	< 0.001
Single parent: Male Head + Biological Children	269	24	2.1	3.7	< 0.001	77	**6.6**	**5.4**	< 0.001
Single parent: Female Head + Biological Children	706	119	**4.0**	**7.5**	< 0.001	232	**7.8**	**6.2**	< 0.001
>2-generational household: Upward extended	77	8	2.3	4.3	< 0.001	8	2.3	1.8	0.104
>2-generational household: Downward +/- Upward	940	49	0.7	1.3	0.107	84	1.2	1.0	-
Head + Parent, No biological children	23	3	2.9	4.9	0.007	5	4.8	4.0	0.003
Skip generational household: Downward +/- Upward	669	136	3.5	6.6	< 0.001	100	2.6	2.1	< 0.001
Sibling only	168	28	**5.5**	**10.1**	< 0.001	61	**12.0**	**9.7**	< 0.001
Head +/- others	208	45	**6.9**	**12.4**	< 0.001	58	**8.9**	**7.2**	< 0.001

[1]: Rates per 100 household years (HYRS)

[2]: Rate ratio relative to the least rate and accounting for the village location and follow-up period

Table 29: Summarising the short-term and long-term rates (per 100 HYRS) of household dissolution and migration by the household's family structure

Family structure	Rates of dissolution		Rates of migration	
	SFP	LFP	SFP	LFP
Single person household: Male	**7.0**	**5.4**	**14.9**	**10.2**
Single person household: Female	**8.8**	**7.4**	**13.0**	**7.9**
Head + spouse(s), no biological children	1.4	1.4	**9.0**	**5.6**
Nuclear: Head + Spouse(s) + Biological Children	0.5	0.5	4.3	3.4
Single parent: Male Head + Biological Children	2.9	2.1	**9.0**	**6.6**
Single parent: Female Head + Biological Children	**5.4**	**4.0**	**11.3**	**7.8**
>2-generational household: Upward extended	1.6	2.3	4.0	2.3
>2-generational household: Downward +/- Upward extended	0.7	0.7	1.4	1.2
Head + Parent, No biological children	**6.1**	2.9	**8.1**	4.8
Skip generational household: Downward +/- Upward vertical extended	3.3	3.5	3.0	2.6
Sibling only	**7.3**	**5.5**	**17.8**	**12.0**
Head +/- others	**7.8**	**6.9**	**17.0**	**8.9**

Households where a single parent was living with his or her biological child(ren) registered high rates of migration irrespective of the age of the parent and if the parent is a man. However if the parent was a woman, the migration rates were higher if the woman was middle-aged. Irrespective of the extended households being less likely to migrate, the rates of migration were increased if the household with more than two generations were headed by an older adult; or if the skip generational household were headed by a man with no resident spouse.

Table 30: Long-term rates (per 100 HYRS) of household dissolution and migration by the household's family structure and the characteristics of the household head

Family structure (Dissolution rates) (Migration rates) (Rates per 100 HYRS)	Household head characteristics											Overall rates
	Resident spouse					Non-resident spouse						
	Male head			Female head		Male head			Female head			
	Child	Middle-aged adult	Older adult	Middle-aged adult	Older adult	Child	Middle-aged adult	Older adult	Child	Middle-aged adult	Older adult	
Single person household: Male							**(4.6) (11.7)**	**(8.7)** (4.0)				**(5.4) (10.2)**
Single person household: Female										**(6.5) (11.0)**	**(8.4)** (4.2)	**(7.4) (7.9)**
Head + spouse(s), no biological children		(1.8) **(6.5)**	(0.5) (2.6)	(1.3) **(6.4)**								(1.4) (**5.6**)
Nuclear: Head + Spouse(s) + Biological Children	(.) (**17.9**)	(0.6) (3.5)	(0.1) (1.6)	(1.4) (**5.3**)	(.) (**73.6**)							(0.5) (3.4)
Single parent: Male Head + Biological Children							(2.5) (**6.8**)	(1.1) (**6.3**)				(2.1) (**6.6**)
Single parent: Female Head + Biological Children									**(69.4)** (.)	**(4.2) (8.2)**	(2.0) (3.7)	**(4.0) (7.8)**
>2-generational household: Upward extended		(0.9) (1.8)	(.) (**11.3**)				**(5.5) (.)**			**(4.8)** (4.8)		(2.3) (2.3)
>2-generational household: Downward +/- Upward extended		(0.2) (1.0)	(0.2) (0.4)	(2.3) (3.5)			**(5.8)** (2.9)	(1.4) (1.4)		(1.1) (2.0)	(1.5) (1.8)	(0.7) (1.2)
Head + Parent, No biological children		(.) (**19.1**)					**(5.1)** (1.7)					(2.9) (4.8)
Skip generational household: Downward +/- Upward vertical extended		(0.9) (3.6)	(0.7) (1.9)		**(4.5) (.)**		(3.3) (**10.0**)	**(12.3) (5.8)**		(2.5) (2.9)	**(4.8)** (2.5)	(3.5) (2.6)
Sibling only							**(5.2) (16.0)**	**(13.0)** (4.3)		**4.7 (6.6)**	**5.4** (1.8)	**5.5 (12.0)**
Head +/- others							**(5.0) (16.0)**	**(16.6) (8.3)**	(.) (**193.3**)	**6.9 (9.9)**	**7.1** (0.9)	**6.9 (8.9)**

4.7 Longitudinal investigation of the changes in the family relationship in the household over time

This section further investigates the change in the family relationships in the GPC household over time contributing to the information provided by the investigation of household survival in the previous section. In fact, unlike the previous section that looked at non-survival, this section looks at the behaviour of the households that survive by looking at their change in structure over time. Both the aspects of survival and structural change will thus contribute to the household FLC model. This will further be used in Chapter 5 to identify any changes (to what is observed in this chapter) corresponding to an experience of HIV infection and mortality in the household. For this investigation, a choice is made to consider the common family structures. The households with these selected family structures at baseline are then observed for any change in their family relationships over four to five years (LFP). The FPs are split into four time intervals as described in Table 31. The cross-sectional investigation showed the common family relationship categories as:

- nuclear: head + spouse(s) + biological children
- >2-generational household: downward +/- upward extended
- head + spouse(s), no biological children
- single parent: female head + biological children
- single parent: male head + biological children
- skip-generational household: downward +/- upward vertical extended

Using the concept used in the transition probabilities technique, the family structure at the start and end of the LFP among the households that survive to the end of the LFP is identified. However, unlike the transition probabilities technique where proportions are generated, I instead generated the percentage of surviving households by change in the structure. At baseline, the family structure of interest are identified and the households followed for the first four to five survey periods (LFPa) to identify the changes in their structure. These households are followed for a further four to five survey periods (LFPb) to identify any additional changes or the return of households that migrated or were lost to follow-up at the

end of the LFPa. Since I observed similar patterns for each of the LFPs, I therefore opted to group the information from all the LFPs from which I generated the percentages of change illustrated below.

Table 31: Description of the follow-up periods in the investigation of household structural change

Follow-up intervals	Description of the long term follow-up periods						
	Baseline survey period	Follow-up period (LFPa)			Additional follow-up period (LFPb)		
		Number of surveys in the follow-up period	Start	End	Number of surveys in the follow-up period	Start	End
1	1989/1990	5	1990/1991	1994/1995	5	1995/1996	1999/2000
2	1994/1995	5	1995/1996	1999/2000	5	2000/2001	2004/2005
3	1999/2000	4	2000/2001	2003/2004	4	2004/2005	2007/2008
4	2003/2004	4	2003/2004	2004/2005	-	- *	- *

*: No additional follow-up undertaken as the survey periods are outside the year range considered in the thesis

Table 32: Comparison of family relational changes during LFPa and LFPb

Baseline age-sex distribution	Follow-up (FP)	Survived to the end of the FP		Did not survive to the end of the FP
		Same distribution at the end of the FP	Different distribution at the end of the FP	
Head + spouse(s), no biological children	LFPa	13.7	57.1	29.3
	LFPb	31.8	47.7	20.5
Nuclear: Head + Spouse(s) + Biological Children	LFPa	60.4	20.9	18.6
	LFPb	64.9	23.8	11.3
Single parent: Male Head + Biological Children	LFPa	26.8	39.6	33.5
	LFPb	30.4	37.5	32.1
Single parent: Female Head + Biological Children	LFPa	35.3	24.9	39.8
	LFPb	41.4	33.8	24.7
>2-generational household: Downward +/- Upward extended	LFPa	58.3	13.2	10.5
	LFPb	64.7	27.5	7.8
Skip generational household: Downward +/- Upward vertical extended	LFPa	53.8	21.5	24.7
	LFPb	57.7	18.2	24.1

A comparison of the change patterns during LFPa and LFPb showed the similar patterns of structure change between the FPs (Table 32). However, frequent change was observed for households with a married couple with no children in the LFPa (with only 13.7% maintaining this baseline structure). However, the likelihood of maintaining the structure throughout LFPb doubled (31.8%) for those that had this structure at the end of the LFPa. In general, there is an overall similarity in the change patterns between changes in LFPa and LFPb. This means that a look at just one of the FPs would adequately present the investigated patterns of change.

Therefore, a particular look at the households which survived to the end of the LFPa (Table 33) showed the most change of households among households with a married couple but no biological children with common changes to the single person (18%) or skip generational (12%) households. However, unlike the households with no biological children, married couples with biological children showed the least change in the family relational distribution in the household with 74% having the same structure at the end of LFPa and 12% changing to an extended structure.

Less frequent changes were also observed for extended and skip generational households with 65% and 71% respectively having the same structure at the end of the LFPa. However, the few that changed from the extended structure changed to the skip generational structure (19%) while the skip generational households changed to the extended structure (13%) or to a single person household (10%).

The single parent households showed moderate change with 40% and 59% with a male and female parent respectively having the same structure at the end of the LFPa. Of those with a male head, 22% changed to a single person household and 22% changed to one with a married couple with children. Of those with a female parent, 23% changed to the extended structure.

Table 33: Percentage of the family relational change occurring among the households that survived to the end of LFPa

Percentage classification of the family relational changes in 4/5year follow-up periods	Baseline family relational structure					
	Head + spouse(s), no biological children	Nuclear: Head + Spouse(s) + Biological Children	Single parent: Male Head + Biological Children	Single parent: Female Head + Biological Children	>2-generational household: Downward +/- Upward extended	Skip generational household: Downward +/- Upward vertical extended
Single person/head only	**17.6**	3.0	**22.0**	6.7	2.7	**10.4**
Head + spouse(s), no biological children	**19.3**	1.8	1.4	0.2	0.6	1.7
Nuclear: Head + Spouse(s) + Biological Children	**44.9**	**74.3**	**22.0**	5.2	5.9	0.5
Single parent: Male Head + Biological Children	1.5	3.4	**40.4**	0.4	1.4	0.3
Single parent: Female Head + Biological Children	0.3	3.3	0.0	**58.7**	4.3	1.5
>2-generational household: Upward extended	0.3	1.4	1.4	1.3	0.3	0.1
>2-generational household: Downward +/- Upward extended	3.6	**11.7**	8.7	**23.3**	**65.2**	**13.0**
Head + Parent, No biological children	0.3	0.0	0.5	0.0	0.1	0.1
Skip generational household: Downward +/- Upward vertical extended	**11.6**	0.9	1.8	3.8	**19.3**	**71.4**
Sibling only	0.6	0.2	1.8	0.5	0.3	1.0
Number of surviving households at the end of the LFP (From which the percentages above are generated)	336	3,398	218	554	1,485	787

4.8 Discussion

This chapter focused on the univariate analysis observing the dynamics of household in respect to the family relational characteristics in the households. The choice of the characteristics was based on the final aim of identifying family member response to HIV infection and AIDS, an aspect that is covered Chapter 5. The characteristics of interest include the aspect of single person households, characteristics of the household head, residency of biological children, extended and skip generational households and households with only sibling residents.

My findings agreed with the hypothesis that a married couple living with biological children was the most common characteristic of the households (38%). However a high percentage of the households had an extended strsucture (17% with a >2-generationally extended structure) were also just as common. The number of skip generational households and single person households were also reasonably many taking up 10% and 13% respectively of the households in a particular survey. Observation over time showed an increase in single person, single female parent, extended and skip generational households over time and a decrease in the households with a married couple with no children. This was also in agreement with my hypothesis with the exception of the sibling only households that showed not much change. This, however, could be attributed to that fact that the sibling only households seem to have a short life-span frequently migrating or dissolving. This was in agreement with my hypothesis.

In addition, most likely to dissolve were single older person households and single female parent households; while most likely to migrate were households headed by a young adult with either a single person, married couple with no children or single parent structure. This was also in agreement with my hypothesis.

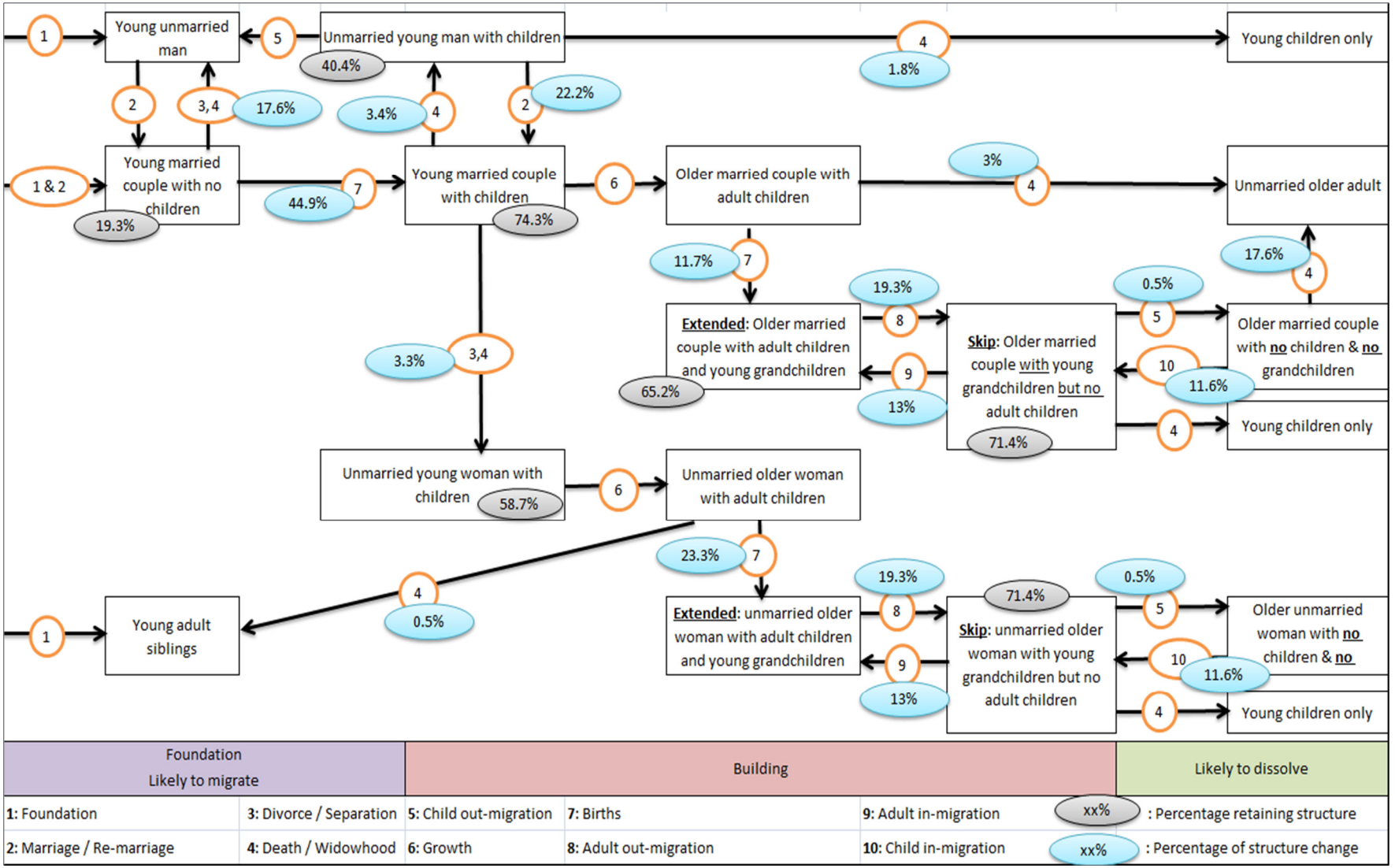

Figure 33: Common household dynamics by family relational characteristics with the events and percentage changes superimposed

The households that were least likely to dissolve or migrate were therefore those with a married couple with children, extended or skip generational structure. These households were also observed as experiencing the least structural change over time. This too was in agreement with my hypothesis. The most change was observed where a married couple had no children most commonly changing to one with children. The single parent households were observed to have moderate changes with the single male parent either attaining a wife or relocating the children or the single female parent changing to an extended household (in agreement with my hypothesis).

To help understand these dynamics further, I adopt the ideas used in the review by Hosegood et al. (2008) identifying the three key stages of household dynamics as foundation, building and dissolution stages. The FLC model generated from the findings of the investigations in this chapter are presented graphically in Figure 33. The model assumes a start at the foundation stage, a stage I found was characterised by households with young residents who are prone to frequent movement thus the high likelihood of migration. This frequent movement could be attributed to young men starting their own households to create 'single person' households and attaining a spouse (marriage) creating a household with a head and spouse with no children.

While movement among young women was mainly attributed to marriage (as shown in section 3.8), in addition to starting their own households, movement of young men was attributed to work. This is in agreement with observations by Seeley (2013) and Barratt et al (2012) who also attribute this movement (among young adults) to the attraction to better employment or trading opportunities and proximity to better services, both essential (for example, medical services, opportunities for further education, transport services, and the availability of household needs such as food) and recreational services such as cinemas, discos, eating places, bars and beaches. This frequent movement thus explains the high migration tendencies of single young adult households and those with a young married couple with no children. These single young adult households were also observed to have high tendencies to dissolve. Section 3.8 shows the dissolution among young adults commonly as a result of the young adults joining other relatives. Seeley (2013) attributes

this to young adults' failure to cope on their own and thus joining another household for support, for example, returning to their parent's home.

The households then transition to the building stage mainly characterised by reproduction, separation/divorce, and out-migration of children and young adults. The most common dynamic in this stage was reproduction among married couples, thus the common change among married couple households with no children.

In addition to being the common structure in the GPC setting, households with a married couple and children (a nuclear structure) were observed as low tendencies of dissolution or migration. However, this stability was altered by events such as a death (widowhood) or a divorce/separation. A death of a spouse is seen to commonly result in a single parent household where the young widower tends to relocate the children to stay with close relatives. This agrees with the findings of Heuveline (2004), Monasch and Boerma (2004), and Chirwa (2004) who observe common relocation to the grandparents. Alternatively, the young man remarries returning the household to the nuclear structure. However, a young widow (woman) tends to stay with her children and has a high tendency of either: migrating with her children to another settlement, dissolving as she and her children relocate to live with relatives, or creating a more stable extended household through the in-migration of an older adult. Section 3.8 showed one of the common reasons of older adult movement is to attain or offer support.

Alternatively, in an event of a separation/divorce, Chirwa et al. (2004) point out that the woman tends to leave the household with the children resulting in a single man household characterised by high tendencies of dissolution and migration. In addition to the high tendency of migration and dissolution, the young adults have high tendencies of re-marrying or reconciling with their former spouse to return to a structure with a married couple with or without children.

The building stage is also characterised by growth where the household residents developed in age for example the nuclear households with a young adult couple with young children to an older adult couple with young adult children. Characterised by frequent movement, the

young adult children were observed to have a high tendency of leaving the parental household resulting in a household with an older adult married couple with no children. Alternatively, the young adult children could have their spouse join them in the parental household creating an extended household.

The last stage, characterised by high tendencies of household dissolution, can start at the point where the older adult couple is left to reside on their own. But, as mentioned above, a separation/divorce or death of a young married adult may lead to the relocation of children to reside with their older relatives for example, grandparents. This can be observed by the households with an older couple with no children changing to a skip generational household when the grandchildren join. Researchers have reported a low prevalence of the skip generational households with less than 2% in cross-sectional studies in South Africa (Noumbissi and Zuberi, 2001, Merli and Palloni, 2004) and in Uganda, 1% in 1992 and 1.6% in 1995 (Ntozi and Zirimenya, 1999). However, the longitudinal investigation in this chapter revealed an annual prevalence of 10% of the skip-generational households in south-western Uganda between 1989 and 2008. This difference could, however, be attributed to differences in the definition of skip-generation households in the different studies. This analysis also found the skip generational households were likely to dissolve as a result of the death of the elderly resident resulting in the children being relocated. However, the study shows instances where the children continue to reside together after the death of the older adult(s), resulting in what I referred to as 'sibling only' households. However, this was found to be common only if at least one of the siblings was a young adult; child only households were very few.

4.9 Conclusion

This chapter has provided further insight into the household dynamic from the perspective of family relationships within the households expounding on the knowledge of household survival and change in structure over time. In summary, low tendencies of the residents not staying together or relocating were observed in households with a married couple with children or with an extended structure. The investigation showed households commonly

transitioning to these 'stable' structures over time. Most commonly, married couples gained children and single parents got married. However, without these changes these households tended to frequently move from place to place. The extended households however showed out-movement of the productive residents leading to a skip generational structure, a structure that I observed to be moderately stable.

However, researchers have hypothesised that these household dynamics are altered by factors such as household member illness or death and are dependent on the wealth status of the household. Based on the findings in this chapter, the effect of adult HIV infection and adult mortality on the household dynamics observed in this chapter will be covered in Chapter 5.

5 EFFECT OF ADULT HIV INFECTION AND ADULT MORTALITY ON HOUSEHOLDS

5.1 Introduction

The HIV epidemic is still evident globally with its epicentre and over 70% of persons living with HIV in sub-Saharan Africa and 89% of these aged 14 or over (UNAIDS, 2012). Studies of sub-Saharan African communities confirm this, finding that most infected adults are of prime or productive age (15-59 years), which is when they are most economically active (Zaba et al., 2004). With AIDS stated and in some cases observed by researchers as the leading cause of death in sub-Saharan Africa (Mulder et al., 1994, Sewankambo et al., 1994, Todd et al., 1997, Nunn et al., 1997, IUSSP, 1997, Ainsworth and Semali, 1998, Kahn et al., 1999, Sewankambo et al., 2000, Dorrington et al., 2001, Urassa et al., 2001, Hosegood et al., 2004b, Porter and Zaba, 2004, Blacker, 2004, Kahn et al., 2007, Jahn et al., 2008, Madhavan et al., 2009, Herbst et al., 2009, Floyd et al., 2010), the mortality rates are stated as being higher among HIV-positive than among HIV-negative adults (Jahn et al., 2008, Herbst et al., 2009, Urassa et al., 2001, Floyd et al., 2010) and higher among females than males (Gregson and Garnett, 2000, Hosegood et al., 2004b).

In the early 1990s, community-based studies in rural Masaka and Rakai in Uganda reported that mortality rates among HIV-positive persons aged 13 and over were over 20 times higher than those among HIV-negative persons of the same age group (Sewankambo et al., 1994, Sewankambo et al., 2000, Kamali et al., 2000). In 2000 a drop to 12.5 times higher than among HIV-negative persons of the same age group was reported (Sewankambo et al., 2000). Similar declines in adult mortality have been reported in community-based studies in KwaZulu-Natal (Herbst et al., 2009) and rural Malawi (Floyd et al., 2010, Jahn et al., 2008), and are associated with an increase in antiretroviral treatment.

5.2 Household dynamics in response HIV infection and/or mortality

HIV infection not only affects the person concerned but also their family and household and the community as a whole. The impact of a case of HIV infection on a person's family and household unfolds gradually, from the point at which they first become sick or discover their HIV status until many years after they have died (Timæus, 2006a). In other words, HIV infection is usually characterised by a prolonged illness leading to death, thus having many short- and long-term consequences for households and their surviving members, for example, increased household mobility (Urassa et al., 2001), household dissolution (Mushati et al., 2003) and the role reversal within households (Mathambo and Gibbs, 2008) The role reversal includes:

- grandparents taking on the role of primary caregivers to their grandchildren instead of being cared for themselves,
- healthy family members having to shoulder an increasing number of responsibilities,
- wives taking up paid employment to secure a household income (in a community where a wife's responsibility is care for the home and the children),
- children having to assume adult roles, for example, seeking employment in an attempt to bring an income into the household.

HIV infection, especially among productive adults, is associated with household disruption, as illustrated in the FLC model by Hosegood et al. (2008) (shown in Figure 34) which includes:

- widowhood and the creation of one-parent households or households with no middle-aged members as children relocate to live with their grandparents on the death of one or both parents;
- divorce and separation due to direct and indirect stresses associated with HIV infection and AIDS such as suspicion and accusations of infidelity (Porter et al., 2004).

- a barrier to forming a new household through marriage or remarriage after divorce or widowhood due to suspicions that the former partner was HIV-positive (Oleke et al., 2005);
- a barrier to reproduction due to fertility decisions not to have children or widowhood;
- the increased risk of household dissolution as the remaining partner chooses to join another household after divorce or the death of a partner, or children join other households or create new households after the death of both parents;
- barrier in the growth of nuclear households with young adult parents to those with older parents attributed to the death of adults or a barrier to the exit of adult children mainly staying home to be cared for by their parents (if the adult children are HIV infected) or alternatively to care for their HIV infected parents.

Household dissolution is also argued to be dependent on the structure of the household before infection, the position of the infected in the household and whether the infected has developed AIDS. For example Figure 34 illustrates:

- the risk of household dissolution was lower among extended larger households than in smaller ones such as nuclear households,
- widowed and divorced male partners remarrying or continuing as single-person households, sending the children to be cared for by grandparents,
- co-residence of older household members or their presence in the neighbourhood reducing the risk of household dissolution by offering support to households that have experienced an adult AIDS death, for example, an aunt living in close proximity supporting her nieces and nephews after the loss of their parents to AIDS. (Hosegood, 2008).

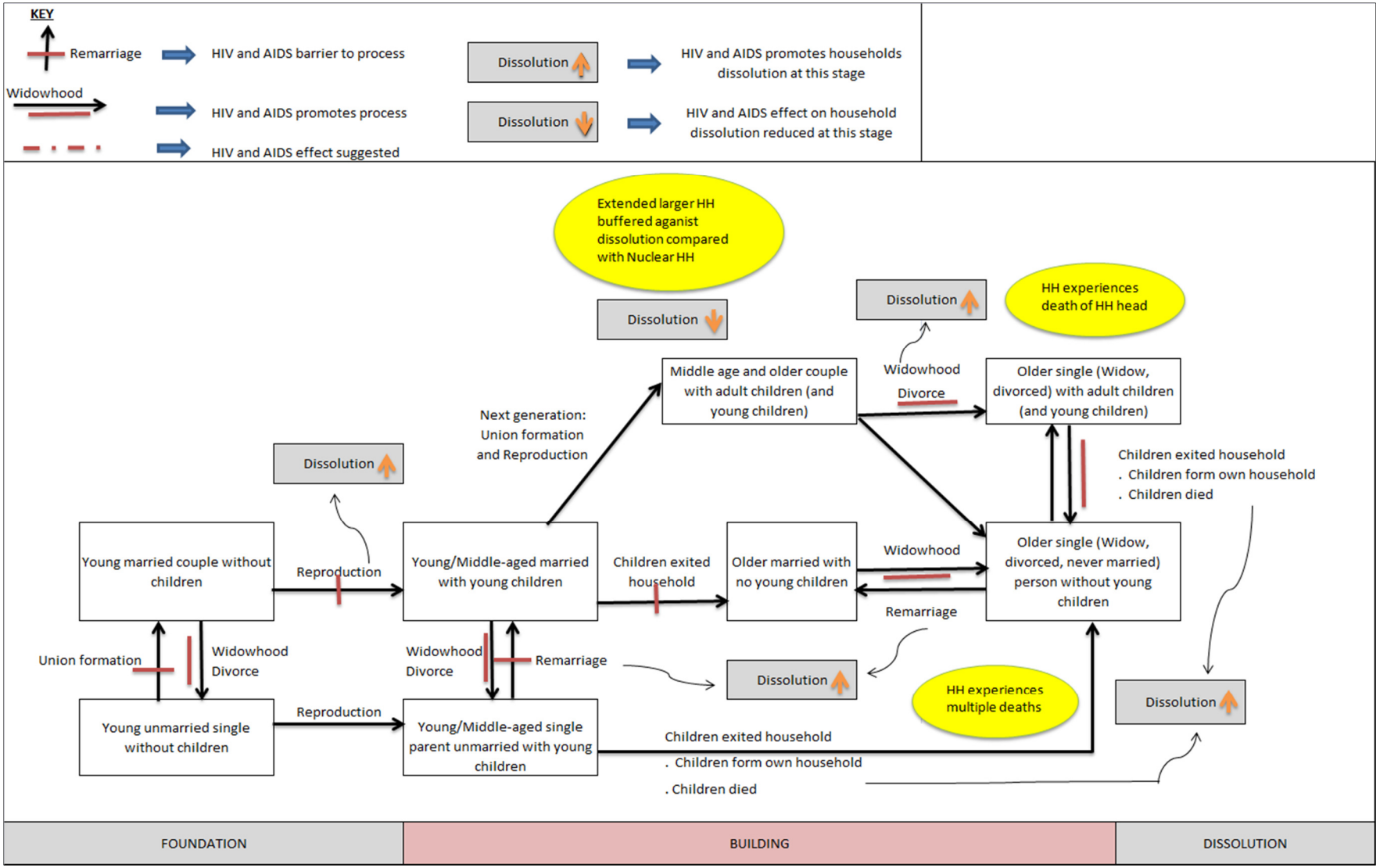

Figure 34: A schematic diagram by Hosegood et al. (2008) showing household disruption due to HIV infection

Studies of the impacts of adult mortality have found no association with whole household migration (Monasch and Boerma, 2004, Heuveline, 2004, Hosegood et al., 2004a, Hosegood, 2006b). In fact the migration of some rather than all the household members is more common as a coping mechanism. The household member migration could be attributed to: dependants being sent to be cared for by others, as evidenced by an increase in child migration (Heuveline, 2004, Monasch and Boerma, 2004); adult residents relocating elsewhere to find work, mainly to boost a household income depleted by the expenses associated with HIV infection and loss of income due to the adult's death (Hosegood et al., 2004a); and the HIV-positive resident relocating to get terminal care (Yamano and Jayne, 2004) or to a preferred place to die (Urassa et al., 2001). The risk of individual migration rises in households that experience multiple deaths although such households are not common (Urassa et al., 2001). Households that are unable to cope dissolve (Hosegood et al., 2004a).

Adult death has been found to be associated with household dissolution, with higher dissolution rates in households where:

- the deceased was the head of the household or his or her spouse, especially if the household head was under 60 years old or female (Urassa et al., 2001, Yamano and Jayne, 2004);
- multiple deaths have occurred (Urassa et al., 2001, Hosegood et al., 2004a, Hosegood, 2006b, Hosegood et al., 2007, Hosegood, 2008);
- the household is small (Yamano and Jayne, 2004).

Households that do not dissolve after the death of the male household head experience an increase in the out-migration of female residents, while if the deceased adult is not the household head or his or her spouse the household tends to experience an increase in the in-migration of new adult residents (Heuveline, 2004, Yamano and Jayne, 2004). No difference has been observed in the rates of dissolution between households that have experienced AIDS-related and non-AIDS-related deaths (Urassa et al., 2001, Mushati et al., 2003, Hosegood et al., 2004a, Hosegood, 2006b).

Researchers predict an increased emergence of:

- households of children living without adults (child-only or child-headed households; sibling-only households);
- single-person and single-parent households with a widowed or divorced head, commonly female;
- households of children and older adults but no younger adults ('skip-generation' households) as more older adults assume a greater role in caring for children (grandparent headed) (Heuveline, 2004, Hosegood, 2008, Mathambo and Gibbs, 2008, CHGA, 2011).

5.2.1 Widowhood and couple separation during the HIV era in Uganda

In the early 1900s, researchers reported that after a death, most of the property of the deceased person in Ugandan societies was inherited by the deceased's heir who could not be the widow. This was usually the deceased's oldest son, brother or close male relative who would also inherit the widow (Ntozi, 1997). The situation was different for widowers. As a result of the high prevalence of polygamy in Ugandan societies, many widowers had other wives to continue marital life with when one wife died. However, for monogamous men, parents of the dead wife replaced her with her sister to be the new wife and look after the children of her deceased sister. This was reported common among the Basoga (Roscoe, 1924), the Baganda (Roscoe, 1911), the Banyankore (Roscoe, 1923), the Bakiga (Edel, 1957) and Basebei (Roscoe 1924). In regards to the children to the deceased, the customs discouraged a widow leaving her children behind and marrying elsewhere. This forced her to stay and marry one of her late husband's agnatic relatives as a means of survival for both her and her children.

However, during the HIV/AIDS epidemic, investigations in the 1990s reported that despite the knowledge that a man had died of AIDS, his widows were inherited and sexual intercourse undertaken/practised between the widows and the inheritor (Bantebya and Konings, 1994). Non-AIDS widows who refused to be inherited by men they suspected to be HIV-infected were left to fend for themselves and their children, which was difficult. The

situation was even worse with AIDS widows who were shunned by in-laws who refused to assist them and their children because they would not inherit them. Obbo (1993) found that widowhood in Uganda results in poverty, worsened by the requirement for the widow to pay off the debts incurred while caring for her sick husband.

In an investigation of the HIV/AIDS epidemic in Uganda, Ntozi (1997) found 43.2% of widowhood in Masaka district (ranking high in AIDS prevalence in Uganda) attributed to AIDS, with the widows and widowers dying off rapidly (Wagner et al., 1993). A look at a sample of 1,797 households covering east, south and western Uganda, Ntozi (1997) observed 65.1% of the widowers remarried compared to a significantly low percentage of 27.3 for the widows. The higher percentages of widowers than widows remarrying were mainly attributed to some men already having other wives and because in Ugandan societies it is easier for men than women to remarry. However, the fear of AIDS discouraged some men from inheriting widows (Berger, 1994). A remarriage could however, be attributed to:

- The custom requirements for widows to be inherited by their late husband's male relatives despite the AIDS epidemic and the awareness of its dangers through educational campaigns (Wawer et al., 1994);
- Widows' desperation for assistance for themselves and their children as this is withheld by the in-laws unless the widowed remarried. The in-laws could even go as far as to evict a widow from her late husband's property. In addition to survival, a widow would need an income or assistance in paying off debts incurred in the treatment of the late husband (Obbo, 1993)
- The fear of an AIDS widow or widower to die alone lead to an attainment of a partner for comfort and support.

Ntozi (1997) further observed migration of a widow and widower less likely if the spouse died of AIDS in comparison to non-AIDS deaths, and even less likely if the widow or widower had a children before the death of the spouse. In addition men were more likely to move than women. Migration of widows was attributed to:

- stigma against widows and widowers forcing them to migrate to escape discrimination for themselves and their children especially if the spouse had an AIDS death,
- the desire to escape a customary forced remarriage,
- a widow's migrating to seek alternative means of survival for herself and her children resulting from the in-laws seizing her properties or refusing to support the her and her children.

Interviews from a community-based randomized clinical trial in Rakai, Uganda showed a strong association between HIV infection among women and divorce or separation and widowhood with the relative odds of widowhood being much larger than those of a divorce or separation (Porter et al., 2004). Separation or divorce after HIV infection could mainly be attributed to: the health effect of the infection limiting the performance of the expected sex roles; or the stigmatization due to sickness or suspicion of the infection being due to infidelity. Separation was more common if the infected person was the woman (in which case the woman was sent away), and higher in discordant (woman positive, man negative: F+ M-) than in concordant (woman and man HIV-positive: F+ M+) unions (Bledsoe, 1990). The husband tended not to send the spouse away if he were HIV-positive mainly due to the woman's caretaking roles. However, the women were unlikely to initiate separation or divorce even in discordant (woman negative and man positive: F- M+) unions due to their limited access to paid employment or inability to return to their parental home.

5.3 Longitudinal investigation of the household dynamics

Most of the findings outlined above have resulted from cross-sectional studies. However, the nature of the epidemic is characterised by a relatively long time between HIV sero-conversion, knowledge of infection and illness. On average an individual not receiving ART may be HIV-positive and asymptomatic for about a decade before developing AIDS and subsequently dying. Therefore the extent of the effects of HIV and AIDS on affected people and households will only be known when households have been observed for periods longer than one year (Bachmann and Booysen, 2003, Hosegood et al., 2007). In addition, a good

knowledge of the household structure before HIV infection, the HIV status of the adult members of the household and a longitudinal follow-up of households over time is required (Heuveline, 2004).

The scarcity of longitudinal impact studies is mainly attributed to the high costs involved in monitoring large numbers of households over several years (Booysen and Arntz, 2003). Some researchers have minimised these costs by drawing information from specific geographical sites purposively chosen for their high rates of HIV infection. Such studies include the Rakai Community Cohort study (RCC) and the General Population Cohort (GPC) in rural south-western Uganda (Ekoru et al., 2010); Mutasa in rural Zimbabwe (Heuveline, 2003); demographic surveillance in Hlabisa in rural north-eastern South Africa (Wittenberg and Collinson, 2007, Hosegood et al., 2004a); Karonga District in northern Malawi (Chirwa et al., 2004), the Kisesa Cohort study in rural north-western Tanzania (Heuveline, 2003); and Manicaland Panel Study in Zimbabwe (Heuveline, 2003). Two longitudinal studies have investigated the effect of HIV infection and mortality on household survival and structural change. These are the Hosegood et al. (2004a) investigation on the impact of adult mortality on household dissolution and migration in rural South Africa, and the Urassa et al. (2001) investigation on the impact of HIV/AIDS on mortality and household mobility in rural Tanzania.

In the Hosegood et al. (2004a) study in KwaZulu-Natal, households were followed for 22 months from January 2000 to October 2002 with a specific focus on adult mortality and its association with household dissolution and migration. HIV infection was only considered in the comparison of the effects of AIDS-related and non-AIDS-related adult deaths, which found no significant difference on the risk of dissolution in households that, had experienced an AIDS-related death compared with those that had experienced a non-AIDS-related one. Other findings include:

- an association between young adult (18-59 years) death and household dissolution
- no association between child (0-17 years) death and household dissolution

- in households that experience a death, no association between the age and sex of the deceased and household dissolution
- increased risk of household dissolution in households experiencing multiple deaths in comparison to households with a single death
- no association between adult mortality and whole household migration.

The Urassa et al. (2001) study in Kisesa involved 10 rounds of demographic surveillance following households between 1994 and 1998, with detailed interviews administered in households which had experienced the death of an adult (15-59 years). This was coupled with the collection of HIV status data from a survey of adult residents aged 15-44 from August 1994 to July 1995 and aged 16-46 from August 1996 to July 1997. The main focus of this study was on individuals rather than on households, to determine the mortality rates by the HIV status, age and sex of the adult residents. The potential association between HIV infection and household disruption was investigated by looking at individual mobility and whole household mobility. In the analysis of whole household mobility, no distinction was made between household dissolution and household migration with whole household member mobility referred to as household dissolution. Like the study in KwaZulu-Natal, HIV infection was considered when comparing the impact of AIDS and non-AIDS deaths, but unlike that study, the Kisesa study looks at the positions of the residents in the household, identifying the head and his/her spouse. The study found that:

- households dissolved only if the deceased was the head of the household, with most households dissolving within five months of the death of the household head,
- individual household members' mobility (not necessarily whole household mobility) was higher where the deceased was a male adult,
- whether the household head's death was AIDS-related or not made no difference to the risk of household dissolution.

In addition, an investigation was undertaken by Ntozi and Zirimenya (1999) to observe changes in household composition and family structure during the AIDS epidemic in Uganda. This multiphase study (described in section 3.3) covered households in six districts in

Uganda that experienced a death in the last 10 years before the survey following them between 1992 and 1995. Using this information, Ntozi and Zirimenya (1999) observed few extended skipped generation households which seem to increase with time. This they attributed to the increase in old people being forced to support their children and grandchildren, promoting not only the creation of the skip extended households but also increasing the dependency ratio.

Also, few of the households observed were the lone male and lone female households. However, there was an increase in monogamous households with children corresponding to a decline in households headed by the separated, divorced and widowed, or the existence of polygamous households where if one spouse dies changes the households structure to a monogamous one.

Most household instability was observed among the female-headed households mainly attributed to non-ownership or inability to access the necessary finances to meet the family's health needs. The female-headed households created after HIV infection result from separation/divorce where the spouse is told to leave, or due to widowhood. In fact with the man alive, the woman is usually required to stay to care for the husband until his death. After the death of the husband, the property owned in marriage is taken by the in-laws with no support rendered to the widow and her children

The observation of household headship (also presented in section 3.3) showed the experience of death resulting in:

- a decrease in female headship and an increase in male headship
- a slight increase in married heads, a decrease in separated/divorced or widowed heads
- a slight decrease in never married heads
- the existence of child headed households though few and a slight decrease observed
- the emergence of households headed by married by women showing an un-involved or non-resident man that is a characteristic of polygamy or inheritance of women by in-laws that are not fully resident.

These longitudinal studies had limited information on individual HIV status and used fairly short FPs of two to three years. The GPC in south-western Uganda, however, has collected household information annually since 1989, with HIV testing of all participants aged 13 and over that consent to a blood test. This provides a good source of household information for a more robust investigation of the effect of adult HIV infection on not only survival of the households (with non-survival defined as the dissolution or migration of the households) but also in the households that survive, the changes in their structure households over time. This will in turn provide answers for the following questions:

- Do dissolution and migration rates differ according to the HIV-positive individuals' position in the household?
    - If yes, which position corresponds to the highest rates of dissolution and migration?
    - Do the dissolution and migration rates differ in households the HIV status of a deceased household member?
- Is the number of adult deaths associated with household dissolution and migration rates?
- Do dissolution and migration rates differ according to the position of the deceased resident?
    - If yes, which position corresponds to the highest rates of dissolution and migration?
    - Do the rates of dissolution and migration differ according to the age and sex of the deceased resident?
- Does the impact of adult HIV infection differ according to the composition or family structure of the household?
    - Is this impact maintained if adult mortality is accounted for?
- Does the impact of adult mortality differ depending on the composition or family structure of the household?
    - Is this impact maintained when the age and sex of the household head and the household's socio-economic status are accounted for?

- Are adult HIV infection and adult mortality associated with structural change in surviving households?
    - Does this association with structural change differ according to the position in the household of the HIV-positive or deceased household resident?
    - What is the pattern of this change?

Guided by findings from other researchers, I hypothesise the following in response to adult HIV infection or adult mortality:

- HIV infection is most among:
    - single parent households or households with a child and a middle-aged man or woman but not both, with the single parenthood resulting from HIV deaths or separation
    - extended households or households with at least a child, middle-aged adult and older adult resident, with the extension created by an in-movement of adults in need of care and their children
- HIV infection less among:
    - Skip generational households or those with no middle-aged adult resident
    - Child only households

    Both the skip generational and child only households characterised by no presence of a middle-aged adult (among whom HIV infection is concentrated)

- As a response to HIV infection of the household head or his spouse:
    - single person households are more likely to dissolve than migrate
    - households with a young adult and children are more likely to lose the children or fully dissolve
    - a young married couple is less likely to have children and the household more likely to evolve to a single person household as a result of a divorce or death
    - households with a young couple with children is more likely to change to one with a single parent household as a result to a death or divorce with those with a:

        - female parent likely to migrate in response to stigma or being close to support;
        - male parent likely to dissolve for care from others
    - single parent households are less likely to change to one with a married couple resulting to reduced cases of remarriage attributed to the fear of HIV infection
    - households are less likely to evolve to an extended household structure but to skip generational households, or to those with no middle-aged adult residents
- A death of one not the household head results in the increase in household survival

Superimposing these hypotheses into the graphical presentation of the hypotheses in Chapter 3 (Figure 7) and Chapter 4 (Figure 29), the updated graphical presentation is presented in Figure 35 and Figure 36 corresponding to the household's age-sex distribution and family structure respectively.

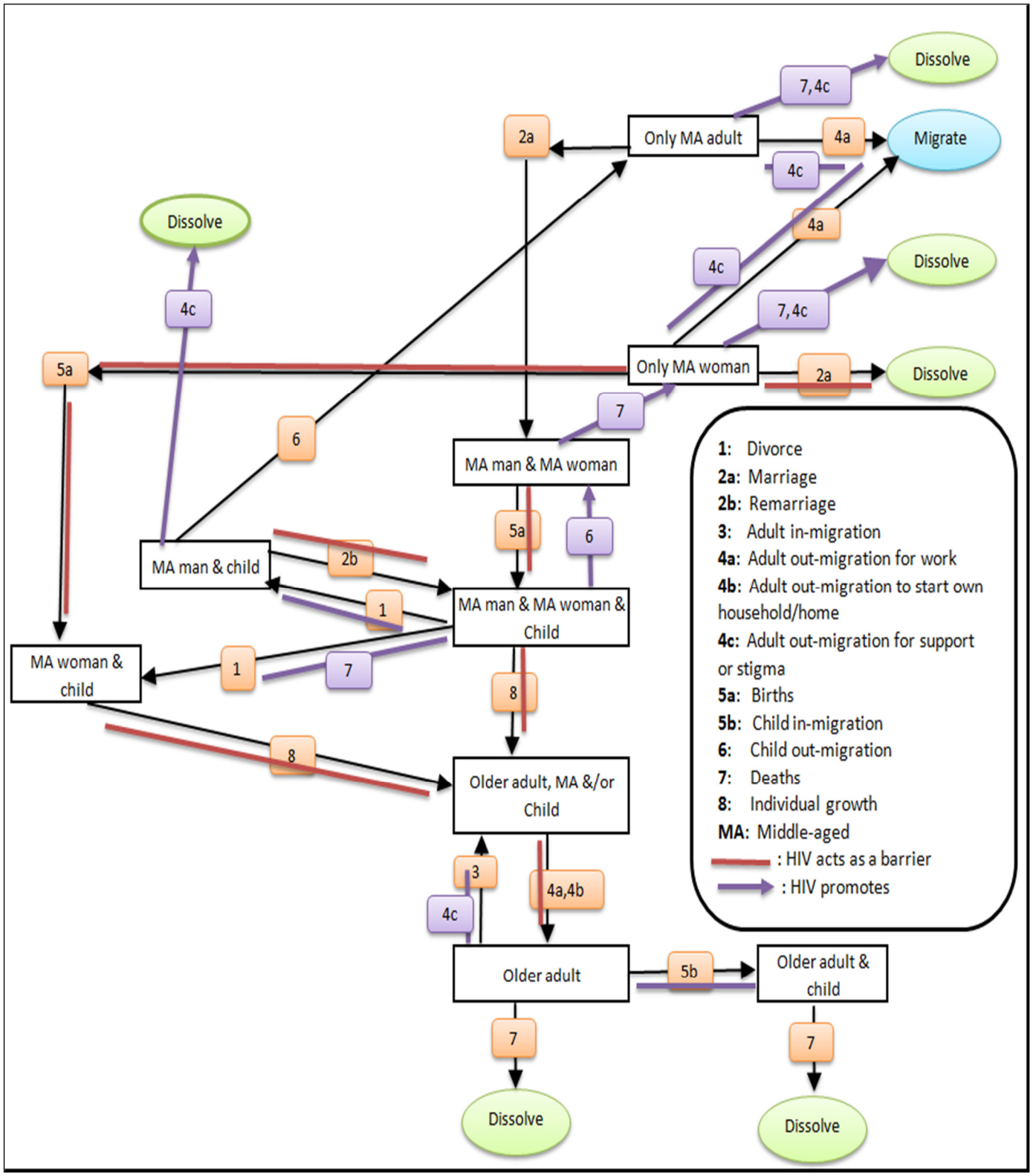

Figure 35: Graphical presentation of hypotheses of households in response to adult HIV infection or adult mortality by the household's age-sex distribution

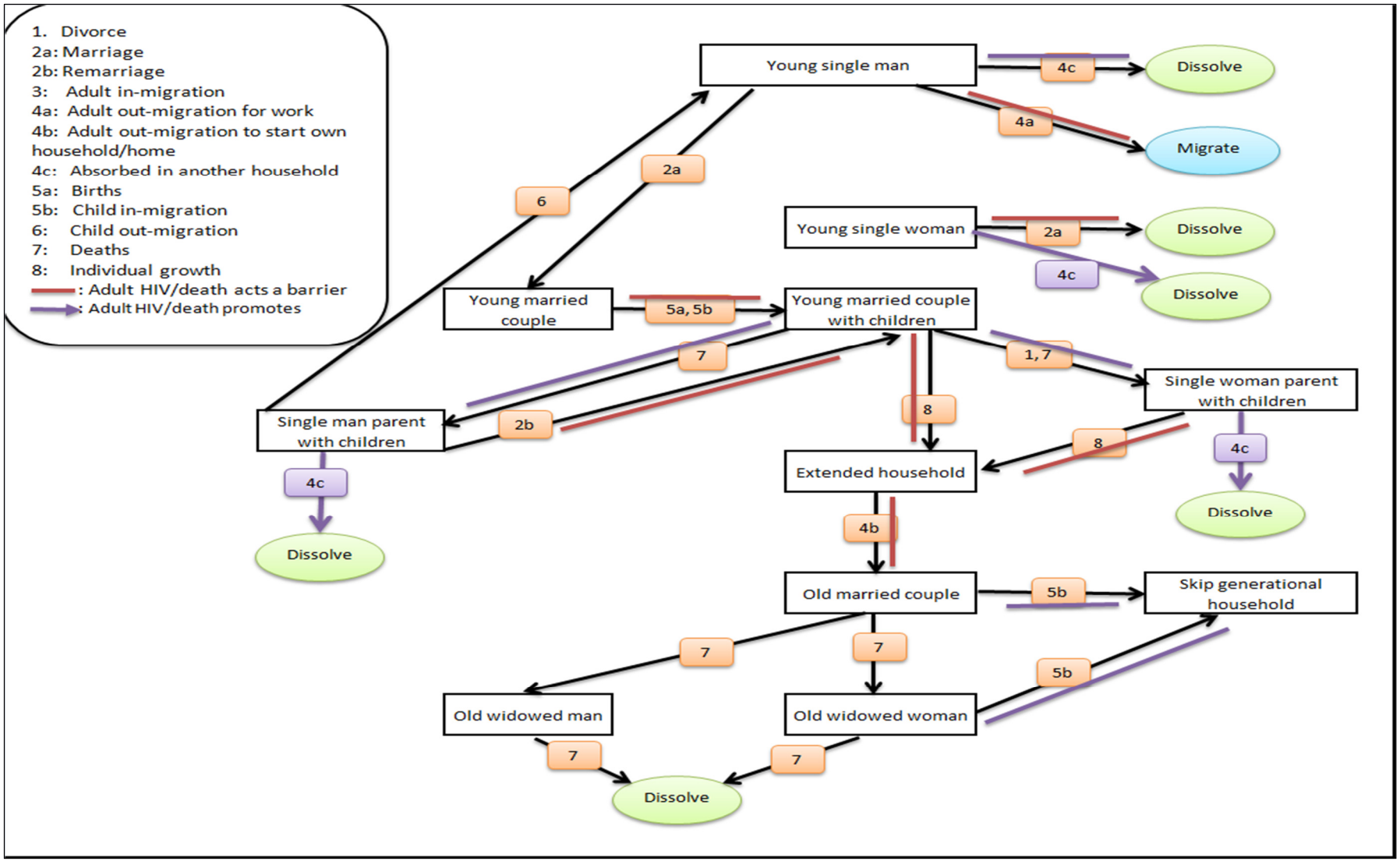

Figure 36: Graphical presentation of hypotheses of households in response to adult HIV infection or adult mortality by the household's family relational structure

To answer the research questions in this chapter and investigate the hypotheses, cross-sectional and longitudinal analyses are undertaken to observe whether adult HIV infection and adult mortality had an impact on the survival, movement and restructuring of households. The cross-sectional analysis looks at the annual description of the infection and mortality in the GPC households. However, the longitudinal analysis follows households for the LFP (described in section 1.4.3) observing the changes of the composition (age-sex distribution, defined in Chapter 3) and family relational structure (defined in Chapter 4) of the households in relation to adult HIV infection or adult mortality in the household. Also observed is whether the survival of the households is affected by the experience adult HIV infection or adult mortality and if this differs according to the structure of the household.

Not only is the infection and mortality identified for the adult household residents (of productive age, aged between 15-59 years) but also by the position of the household residents, specifically identifying the household head and the spouse. In addition, with the data providing a clear distinction between household dissolution and household migration, household dissolution and migration is looked at separately.

5.4 HIV infection in the GPC study setting

Averaging across the 19 suvey periods from 1989 to 2008, the findings show 13.2% households had at least one HIV-positive resident during any one survey period, with little change in the distribution over time (Figure 37). Similarly, of all the households that participated in the study, 23% had an HIV-positive resident at least once during the study period.

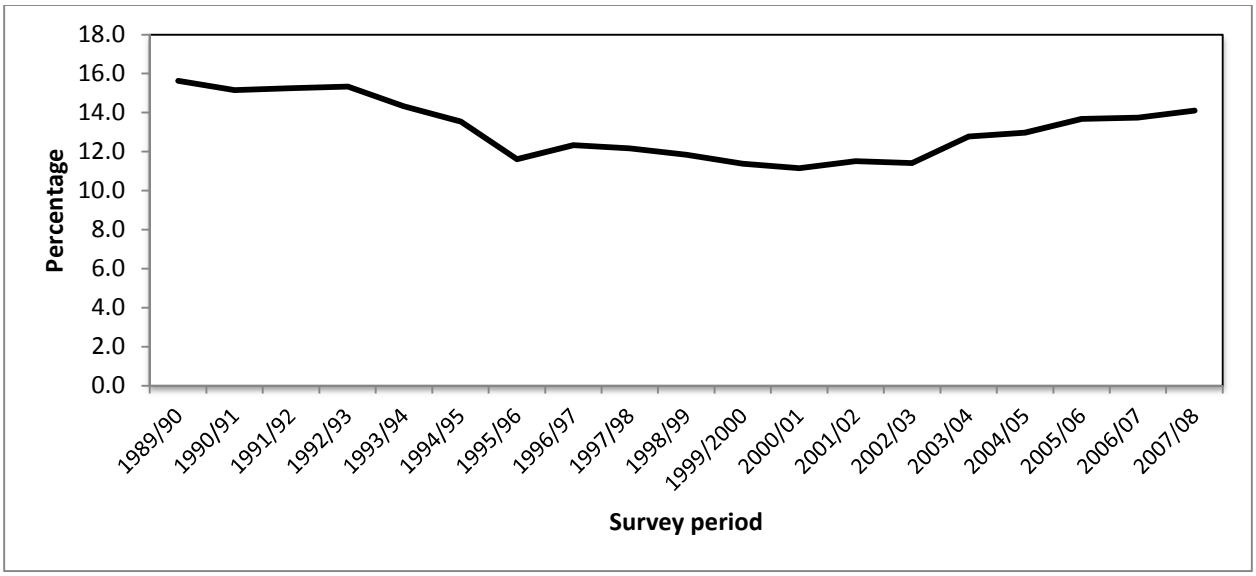

Figure 37: Percentage of households with at least one HIV-positive resident

Table 34: Household infection by the position of the infected resident

Resident spouse: Total number of households - A=5,675		
Description of HIV infection experienced by a household at least once during the study period (1989 - 2008)	**Number of households (N)**	**Percentage of households ([N/A]X100)**
Head & Spouse HIV+	252	4.4
Head HIV+ , Spouse HIV-	247	4.4
Head HIV-, Spouse HIV+	271	4.8
Head & Spouse HIV-, MA HIV+	338	6.0
Head & Spouse & MA HIV-, Other HIV+	93	1.6
Non-resident spouse: Total number of households - B=4,007		
Description of HIV infection experienced by a household at least once during the study period (1989 - 2008)	**Number of households (N)**	**Percentage of households ([N/B]X100)**
Head HIV+	659	16.4
Head HIV-, MA HIV+	394	9.8
Head & MA HIV-, Other HIV+	58	1.4
No HIV+ resident throughout the study period (percent =(N/T)x100)	6,064	77.0
Total number of households that participated in the GPC at least once between 1989 and 2008 (T)	7,875	

Among the households where the household head had a resident spouse, 4.4% of the households reported both the head and spouse HIV-positive, 4.4% reported an HIV-positive head and a HIV-negative spouse, while 4.8% reported an HIV-negative head and an HIV-positive spouse (Table 34). The percentage of households with the HIV resident being a middle-aged adult that is not the head or spouse was slightly higher at 6%. Alternatively, among the households where the head had no resident spouse, the infection was reported most was that of the household head (16.8%).

A cross-sectional comparison of the composition of households with at least one HIV-positive resident (affected) and those with none known (unaffected) shows that the the mean household size over the 19 survey periods was slightly higher in the affected households (5.7 in the affected and 5.1 in the unaffected households). The mean dependency ratio was slightly lower in the affected households with a mean dependency ratio of 2.8 in affected households and 3.2 in the unaffected households.

In addition, across all the 19 survey periods, the percentage of households with at least one HIV-positive resident ([number of households with an HIV-positive resident/total number of households] x 100) by age-sex distribution (household composition typology developed in Chapter 3) presented in Figure 38 shows HIV infection most among households with:

- only a child(ren) and middle-aged man(men) resident (18.3%)
    - Among which the middle-aged head was the commonly infected resident (84%)
- only a child(ren) and middle-aged woman(women) resident (16.7%)
    - Among which the middle-aged head was commonly infected resident (84%)
- atleast a child, middle-aged man, middle-aged woman and older adult resident (16.8%)
    - Among which the infected was commonly the middle-aged that was not the household head (71.8%),

and least infection was among households with:

- only children resident (0%)

- only older adults resident (3%)
- only a child(ren) and older adult(s) resident (3.8%)

By family relational structure (developed in Chapter 4) Figure 39 shows HIV infection most among:

- households with a head coresident with his/her parent (28.6%), over 47% with the head infected
- households extended upwards (23.9%)
- single parent households coresident with children (female parent (18.3%), male parent (20%)), with over 80% having the parent infected

; and least among:

- the skip generational household (7.9%)
- single person households (male (8%) and female (8.8%))

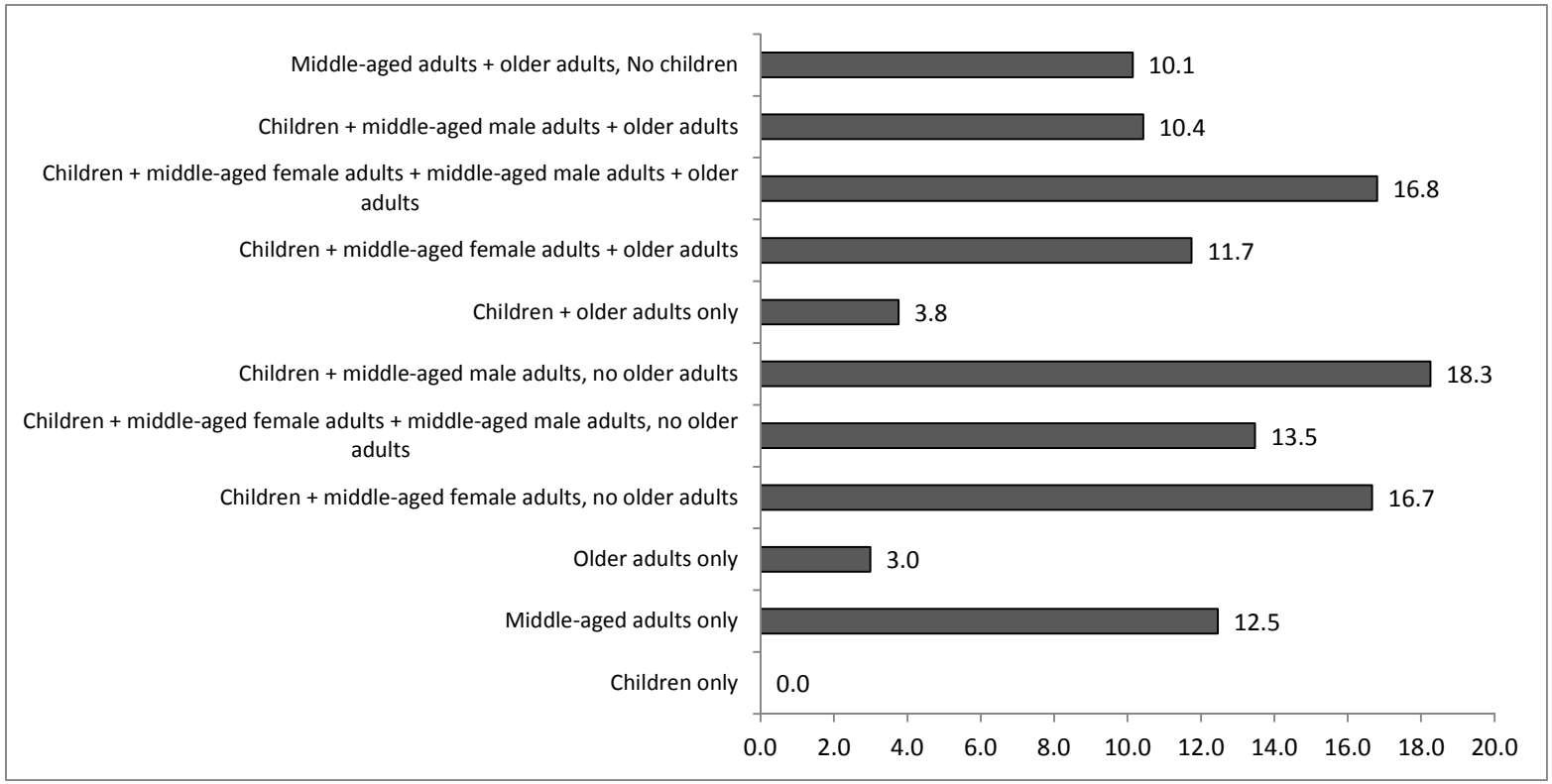

Figure 38: Percentage of households with at least one HIV+ member, by age-sex distribution

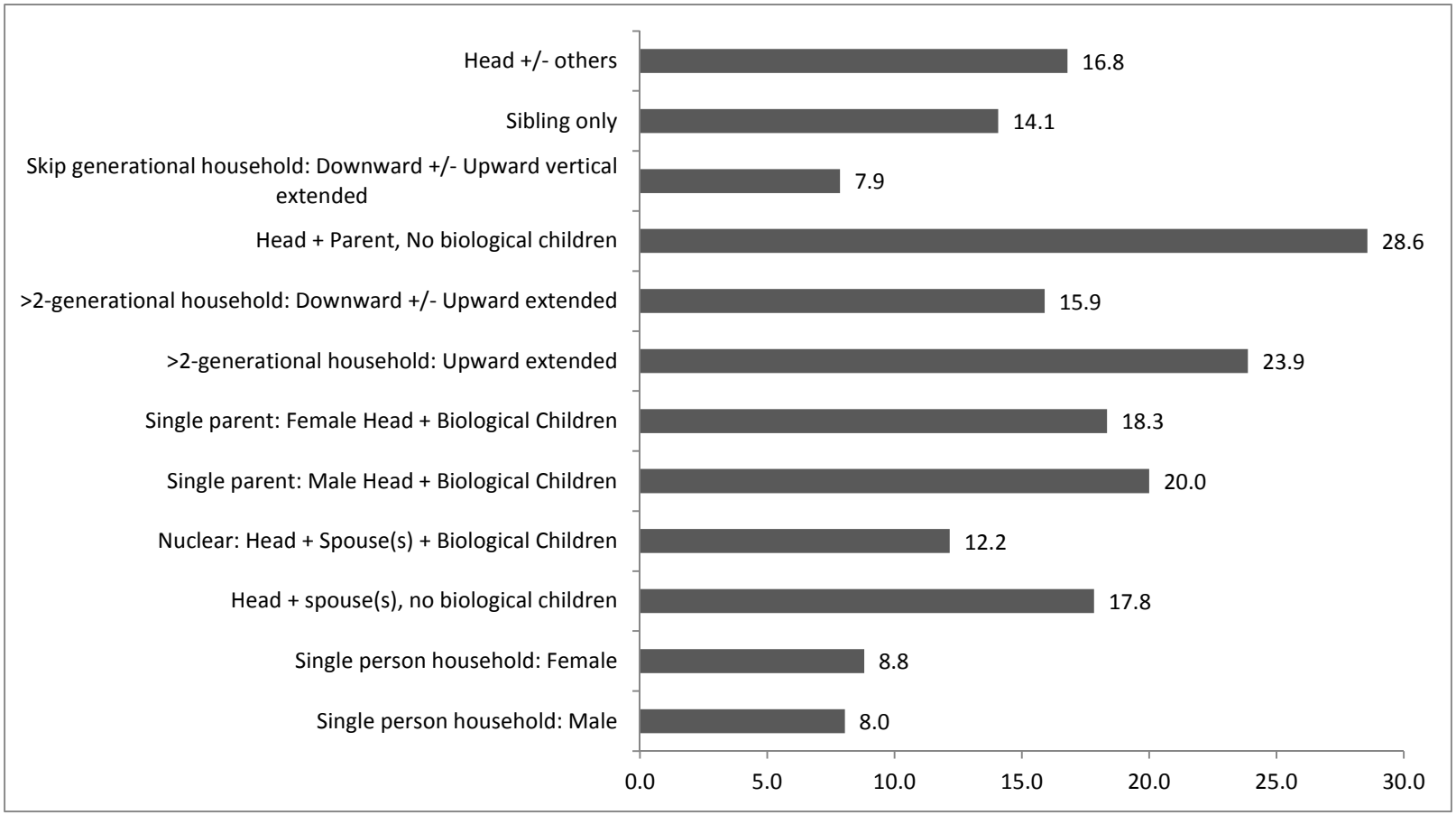

Figure 39: Percentage of households with at least one HIV+ member, by family structure

5.5 Mortality in the GPC study setting

A percentage of 24.3% (1,910) of the 7,875 households that participated in the GPC between 1989 and 2008 experienced a death of at least one resident during this period. Of the households that experienced a death, 30.8% was a death among those known to be HIV-positive before the death.

Classifying the deaths by the position of the deceased in the household (Table 35):

- 1% reported the deaths of both the household head and his/her spouse in the same survey; 19.3% experienced the death of the head, survived by his or her spouse; 10.9% experienced the death of the head's spouse; and 32.5%, experienced the death of the household head (male 14.4%, female 18.1%) who did not have a resident spouse.
- in households that did not experience a death of the head and his/her resident spouse, 11.4% experienced the death of another adult resident of productive age, while 11% of households with a living household head with no resident spouse experienced the death of another adult resident of productive age.

Including the aspect of HIV infection at the time of death (Table 35):

- 47.4% of the 19 households that experienced the death of the household head and his/her spouse, both were known to be HIV-positive;
- 26.6% of the 368 households that experienced the death of the household head survived by his/her spouse, the head was known to be HIV-positive. While 35.9% of the 209 households with the household head surviving and a death of his/her spouse, the deceased spouse was known to be HIV-positive. In addition, 56.3% of surviving spouses and 59.5% of surviving heads were also known to be HIV-positive;
- 37.5% of the 275 households with a deceased male head with no resident spouse and 28.1% of the 345 households with a deceased female head with no resident spouse was a death of the head known to be HIV-positive;

- of 218 households where a head and spouse were living together and experienced a death of at least one adult of productive age that was not the head or spouse, 55% was a death of one known to be HIV-positive. While, 55.5% of the 211 households with a living household head with no resident spouse experienced the death of at least one other adult of productive age known to be HIV-positive.

Overall 94% of the 588 households that experienced the death of a resident known to be HIV-positive was a death of the household head, his/her spouse or any other resident of productive age.

Table 35: Distribution of household mortality by the position role of the deceased residents

Household resident experiencing a death		Number of households that experience the death event at-least once in the 19 years (A)	Percentage of the total number of households that experience a death at-least once (A/1,910)*100	The number of households that experience a death of one known to be HIV+ (B)	Percentage of the households that experience a death of one known to be HIV+ to the total number of households that experience a death (B/A)*100
Households with a resident spouse	Head & spouse dies	19	1.0	9	47.4
	Head dies , spouse alive	368	19.3	98	26.6
	Head alive, spouse dies	209	10.9	75	35.9
	Head & spouse alive, MA dies	218	11.4	120	55.0
	Head & spouse & MA alive, other dies	669	35.0	40	6.0
Households with no resident spouse	Male head dies	275	14.4	103	37.5
	Female head dies	345	18.1	97	28.1
	Head alive, MA dies	211	11.0	117	55.5
	Head & MA alive, other dies	277	14.5	20	7.2
Number of households that experienced a death at-least		1,910 *1		588 *2	30.8

MA: Adult residents aged between 15 and 59 years **other**: Residents aged less than 15 years or more than 59 years

*1: The number of households in this column does not add up to 1,910 - this is because for instance, one of the 368 households that experienced a death of the head with his/her spoouse alive in one survey period could experience a death of the surviving female head in another survey period thus being counted again under the 345 households where the surviving spouse dies in a household with no resident spouse

*2: The number of households in this column does not add up to 588 - this is because for instance, one of the 98 households that experienced a death of an HIV+ head with his/her spoouse alive in one survey period could experience a death of the surviving HIV+ female head in another survey period thus being counted again under the 97 households where the surviving HIV positive spouse dies in a household with no resident spouse

5.6 The association between adult HIV infection and mortality and dissolution and migration of GPC households

This section presents the investigation an association between HIV infection and mortality of household residents and the non-survival (dissolution or migration) of the household. The effect is observed by generating the rate ratios of dissolution and migration comparing the rates in the households that experienced HIV infection or mortality among the residents to those that did not. The investigation takes into consideration the position, composition and family relational characteristics of the residents, the socio-economic status of the households and the length of the exposure. The position of the residents is classified by identifying:

- the household head,
    - sex
    - age, differentiating the middle-aged (15-59 years) and older (over 59 years) heads
- the spouse of the head,
- other middle-aged (15-59 years) residents and
- other residents that are children (aged under 15 years) or older adults (over 59 years)

The composition characteristics are represented by the age-sex distribution typology described in Chapter 3 and the family relational characteristics of the household members represented by the family structure typology developed in Chapter 4. In regards to a household's SES, as mentioned in Chapter 1 (section 1.2.2.1), the GPC collects household SES information in its four-yearly household questionnaire. However as mentioned in section 1.2.2.1, not all the SES indicators are collected in each of the GPC surveys with some dropped or new ones are introduced from household survey to the next. For the SES measure, the indicators collected in survey 1989/1990 is used and related to the households that refer to the survey 1989/1990 as baseline in a longitudinal investigation. For the length of exposure, short-term (annual) and long-term (4 to 5 years) longitudinal investigations are undertaken.

5.6.1 Length of exposure

The rate ratios of dissolution and migration in the short-term and long-term, though different, show the same outcome (Table 36). They all show the evidence (p-value<0.001) of the rates higher in the households that had at least one HIV-positive resident or experienced a resident death at baseline to those that did not. At this point, I chose to use the long-term length of exposure.

Table 36: Overall rate ratios of dissolution and migration by experience of HIV infection or mortality

Household resident experience of:	Analysis description	Rate ratio (rates of experience in reference to no reported experience)	
		Dissolution	Migration
HIV infection	**overall**		
	short term	1.84 (p<0.001)	1.24 (p<0.001)
	long term	2.04 (p<0.001)	1.35 (p<0.001)
	adjusting for SES (Long term)		
	unadjusted	1.82 (p=0.002) (C.I: 1.25 - 2.65)	1.81 (p<0.001) (C.I: 1.39 - 2.35)
	adjusting for SES	2.07 (p<0.001) (C.I: 1.42 - 3.04)	2.02 (p<0.001) (C.I: 1.55 - 2.63)
Mortality	**overall**		
	short term	11.59 (p<0.001)	1.44 (p<0.001)
	long term	4.25 (p<0.001)	1.05 (p<0.001)
	adjusting for SES (Long term)		
	unadjusted	3.98 (p<0.001) (C.I: 2.65 - 5.96)	1.15 (p=0.551) (C.I: 0.73 - 1.81)
	adjusting for SES	6.02 (p<0.001) (C.I: 3.93 - 9.22)	1.64 (p=0.034) (C.I: 1.04 - 2.60)

5.6.2 Accounting for socio-economic status

Investigating whether accounting for the household's SES, households in the first LFP are considered. The investigation is in reference to HIV experience and the household SES in baseline survey period 1989/1990 and mortality experience during this first LFP. Overall, Table 36 shows the accounting for SES resulting to not much difference in the rate ratio outcome in relation to the unadjusted rate ratio with the evidence of the effect of HIV infection and mortality maintained in both investigations. However, since the adjusted rate ratios are slightly greater than the unadjusted ones, this shows some potential negative confounding. However, the differences in the rate ratios are small (especially when looking at the confidence intervals) and both analyses yield the same outcome which is a strong evidence that adult HIV infection and mortality promote both household dissolution and migration.

5.6.3 Position of the household resident

5.6.3.1 Effect of HIV infection

The rates of dissolution and migration by the experience of HIV infection by position of the infected household members showed the rates highest if the infected resident was the household head or spouse (Table 37). The rates were higher if the HIV-positive head or spouse died (rate ratio of experience of a death of an HIV-positive relative to an HIV-negative head or spouse: dissolution 6.16 ($p<0.001$); migration 1.23($p=0.131$)). Therefore for further investigation relating to HIV infection, the infection of the household head or spouse was considered accounting for death of the head or spouse.

Table 37: Long-term effect of HIV infection on household dissolution and migration

Description of household experience	Number of households*	Dissolution		Migration	
		Rates (per 100 HYRS**)	Rate ratio (p-value)	Rates (per 100 HYRS**)	Rate ratio (p-value)
Experience of HIV infection					
Head and/or spouse HIV+ at baseline	643	5.3		8.1	
Head & Spouse HIV- at baseline and throughout follow-up period, Middle-aged adult HIV+ at baseline	312	1.1		1.9	
Head & Spouse & Middle-aged adult HIV- at baseline and throughout follow-up period, other residents HIV+ at baseline	62	2.0		2.4	
None known to be HIV+ at baseline and throughout	4,633	1.9		4.4	
Experience of a death of an HIV positive household head					
Experience head and/or Spouse death at baseline or during the follow-up period	275	13.5	6.16 (<0.001)	9.4	1.23 (0.131)
Experience no head and/or Spouse death at baseline and throughout follow-up period	462	2.2		7.6	

*: Household years

**: Number of households the specific characteristic mortality in the follow-up period

5.6.3.2 Effect of resident mortality

Irrespective of the HIV infection, the rates of dissolution were highest in the households where the head or spouse died (rate=18.6 per 100 HYRS). There was evidence that the rates were even higher if the deceased household head was male (relative to female: rate ratio = 2.98, p<0.001); middle-aged (relative to older: rate ratio=1.87, p=0.001); and significantly lower with the experience of multiple deaths (relative to one resident death: rate ratio=0.62, p=0.004; or one adult death: rate ratio=0.55, p=0.007).

However, the rates of migration were highest in the households where the deceased at baseline was the household head or spouse (rate=8.5 per 100 HYRS), and evidence that rates are higher if the deceased household head was female (relative to a male head: rate ratio=2.2, p=0.013) or middle-aged (relative to an older head: rate ratio=4, p<0.001). There was no evidence of the rates of migration differing by the number of deaths; however the rates of

migration were least among the households that experienced at least one adult death during the follow-up period.

Therefore in the further investigation relating to mortality in the household, considered was the death of the household head or spouse accounting for the age and sex of the household head.

Table 38: Long-term effect of resident mortality on household dissolution and migration

Description of household experience	Number of households*	Dissolution		Migration	
		Rates (per 100 HYRS**)	Rate ratio (p-value)	Rates (per 100 HYRS**)	Rate ratio (p-value)
Experience of mortality in the household					
Head and/or spouse death at baseline	289	18.6		8.5	
No head & spouse death at baseline and throughout follow-up period, middle-aged adult death at baseline	89	1.6		2.2	
No head & spouse & middle-aged adult death at baseline and throughout follow-up period, other residents death	191	1.4		3.0	
No death reported at baseline and throughout follow-up	4903	1.3		4.8	
Sex of the household head that die at baseline					
Female	95	46.9	2.98 (<0.001)	14.1	2.20 (0.013)
Male	150	15.7		6.4	
Age of the household head that die at baseline					
Middle-aged (15-59 years)	99	36.0	1.87 (0.001)	18.0	4.0 (<0.001)
Older (60+ years)	143	19.2		4.5	
Number of adult (aged 15+ years) deaths accumulated from baseline and throughout the follow-up period					
No deaths	5,021	1.2		4.6	
1 death	1,198	7.9	0.55 (0.007)	3.5	1.12 (0.624)
Multiple deaths	131	4.3		4.0	
Number of ALL deaths accumulated from baseline and throughout the follow-up period					
No deaths	4903	1.3		4.8	
1 death	1537	5.6	0.62 (0.004)	3.2	0.93 (0.701)
Multiple deaths	267	3.5		2.9	

*: Household years

**: Number of households the specific characteristic mortality in the follow-up period

5.6.4 Age-sex distribution

5.6.4.1 HIV infection, dissolution

By experience of household head or spouse HIV infection, stratifying by the age-sex distribution Table 39 shows no evidence of differing age-sex distribution specific adjusted rate ratios (p=0.200). However, evidence of the rates higher in households with an HIV-positive household head or spouse (relative to those with no HIV-positive head or spouse) was observed in households with a child, middle-aged man living with either a middle-aged woman (rate ratio=1.9, p=0.003) or older adult (rate ratio=5, p=0.002).

5.6.4.2 HIV infection, migration

Alternatively there was evidence that the rates of migration were higher in the households with an HIV-positive head or spouse relative to those without. This was specifically observed in households with at least a middle-aged woman resident, specifically households with a child, middle-aged man and middle-aged woman with (rate ratio=3.9, p=0.005) or without an older adult (rate ratio=1.7, p<0.001); and those with a child and middle-aged woman with (rate ratio=3.5, p=0.084) or without an older adult (rate ratio=2.3, p<0.001). The evidence is maintained after adjusting for household head or spouse mortality.

5.6.4.3 Mortality, Dissolution

By experience of household head or spouse death (Table 39) there was evidence of differing age-sex distribution specific rate ratios of dissolution (p<0.001) with the all the age-sex distributions showing evidence of rates of higher dissolution in households that experienced household head or spouse death relative to those that did not. The rate ratios were highest in households with at least an older adult resident specifically those with a:

- child and older adult (rate ratio=49.9)
- child, middle-aged man and older (rate ratio=36.8)
- child, middle-aged man, middle-aged woman and older (rate ratio=24.6)
- older adult only (rate ratio=18.6)
- child, middle-aged woman and older adult (rate ratio=16.5).

The rate ratios were least in households with a child and both a middle-aged man and middle-aged woman resident (rate ratio=6.9).

5.6.4.4 Mortality, migration

By experience of household head or spouse death (Table 39), there was evidence of differing age-sex distribution specific rate ratios of migration ($p<0.001$). The rates of migration were higher in the households with a death of the household head or spouse relative to those without. Further, the rate ratios of experience of a head or spouse death relative to no death experience were specifically higher among households with at least a middle-aged woman resident, which is among households with:

- child, middle aged man and middle-aged woman with (rate ratio=3.8, $p<0.001$) or without an older adult (rate ratio=1.9, $p<0.001$); and
- those with a child and middle-aged woman with (rate ratio=2.5, $p=0.008$) or without an older adult (rate ratio=3.2, $p<0.001$).

Evidence that the rates were lower in the households with a death (relative to those with no death) was observed in those with only middle-aged adults (rate ratio=0.5, $p=0.008$) or older adults (rate ratio=0.2, $p=0.021$) resident.

Table 39: Summarising the long-term rate ratios of dissolution and migration relative to the household experience of household head or spouse HIV infection or mortality

Description of the household's structure	Number of households [*1]	Rate ratio(p-value) [*2] of dissolution and migration in response to household head/spouse experience of:			
		HIV infection [*3]		Death [*4]	
		Dissolution	Migration	Dissolution	Migration
Age-sex distribution					
Children + Middle-aged female adults + Middle-aged male adults, no older adults	2,743	**1.9 (0.003)**	**1.7 (<0.001)**	7.3 (<0.001)	**1.9 (<0.001)**
Middle-aged adults only	1,489	1.4 (0.047)	1.1 (0.583)	10.4 (<0.001)	*0.5 (0.008)*
Children + Middle-aged female adults, no older adults	719	1.1 (0.793)	**2.3 (<0.001)**	7.1 (<0.001)	**3.2 (<0.001)**
Children + Middle-aged female adults + Middle-aged male adults + older adults	646	2.7 (0.060)	**3.9 (0.005)**	**24.6 (<0.001)**	**3.8 (<0.001)**
Children + Middle-aged female adults + older adults	459	2.2 (0.434)	3.5 (0.084)	16.5 (<0.001)	**2.5 (0.008)**
Middle-aged adults + Older adults, No children	268	1.7 (0.324)	1.4 (0.680)	8.2 (<0.001)	1.4 (0.366)
Older adults only	321	1.1 (0.895)	**3.6 (0.034)**	18.6 (<0.001)	*0.2 (0.021)*
Children + Older adults	254	2.3 (0.075)	2.2 (0.288)	**49.9 (<0.001)**	0.7 (0.423)
Children + Middle-aged male adults, no older adults	189	1.7 (0.350)	0.9 (0.820)	9.1 (<0.001)	1.4 (0.534)
Children + Middle-aged male adults + older adults	203	**5.0 (0.002)**	2.3 (0.433)	**36.8 (<0.001)**	2.8 (0.074)
stratification rate ratio		1.5 (<0.001)	1.6 (<0.001)	12.7 (<0.001)	1.5 (<0.001)
p-value of difference in rate ratios		0.200	0.014	<0.001	<0.001
Family structure					
Nuclear: Head + Spouse(s) + Biological Children	2,378	**2.4 (0.001)**	**1.7 (<0.001)**	4.8 (<0.001)	**1.9 (<0.001)**
>2-generational household: Downward +/- Upward extended	940	2.3 (0.077)	**3.4 (0.001)**	13.4 (<0.001)	**3.6 (<0.001)**
Single person household: Male	1,002	1.1 (0.573)	1.2 (0.380)	**17.6 (<0.001)**	*0.2 (0.003*
Skip generational household: Downward +/- Upward vertical extended	669	**3.0 (<0.001)**	2.4 (0.092)	**33.9 (<0.001)**	0.9 (0.753)
Single parent: Female Head + Biological Children	706	1.3 (0.345)	**1.8 (<0.001)**	5.2 (<0.001)	**3.3 (<0.001)**
Head + spouse(s), no biological children	416	**3.0 (0.012)**	**1.9 (0.011)**	4.1 (<0.001)	0.8 (0.599)
Single person household: Female	312	1.7 (0.090)	**2.2 (0.021)**	**12.6 (<0.001)**	-
Single parent: Male Head + Biological Children	269	1.3 (0.617)	1.2 (0.514)	**15.0 (<0.001)**	**3.0 (<0.001)**
Head +/- others	208	1.9 (0.081)	1.8 (0.207)	12.9 (<0.001)	*0.7 (0.471)*
Sibling only	168	1.9 (0.286)	1.2 (0.786)	10.0 (<0.001)	-
>2-generational household: Upward extended	77	**29.9 (<0.001)**	2.7 (0.315)	**5.6 (0.035)**	2.8 (0.344)
Head + Parent, No biological children	23	-	4.2 (0.198)	-	-
stratification rate ratio		1.7 (<0.001)	1.7 (<0.001)	13.2 (<0.001)	1.5 (<0.001)
p-value of difference in rate ratios		0.003	0.488	<0.001	< 0.001

[*1] the number of households that had the structure in at-least one of the long term baselines - due to this a household can be categorized I more than one household structure during the overall follow-up period (FP) which included 4 long term FPs

[*2] High or rate ratios with a p<0.05 with those a rate ratios>1 bolded; and those with a rate ratio<1 highlighted and in italics

[*3] Adjusted rate ratio accounting for the death of the household head/spouse

[*4] Adjusted rate ratio accounting for the age and sex of the household head

5.6.5 Family structure

5.6.5.1 HIV infection, dissolution

By experience of household head or spouse HIV infection, a stratification by a household's family structure (Table 39) showed evidence of differing family structure specific rate ratios of dissolution (p=0.003). Evidence of higher rates of dissolution in households with an HIV-positive head or spouse relative to those without was observed for those with:

- a married couple with (rate ratio=2.4, p<0.001) or without children (rate ratio=3.0, p =0.012),
- a skip generational household structure (rate ratio=3.0, p<0.001), and
- a structure extended upwards (rate ratio=29.0, p<0.001, with the large rate ratio attributed to the small number of households with this category also characterised by a wide confidence interval [5.5 , 161.9]).

5.6.5.2 HIV infection - Migration

Alternatively, there was no evidence of differing family structure specific rate ratios of migration (p=0.488). However, some evidence of the rates of migration being higher in the households with an HIV-positive household head or spouse was in households with a married couple with (rate ratio=1.7, p<0.001) or without children (rate ratio=1.9, p=0.011); extended both upwards and downwards (rate ratio=4.2, p<0.001); single woman resident (rate ratio=2.2, p=0.021) and single woman parent households (rate ratio=1.8, p<0.001).

5.6.5.3 Mortality, dissolution

By experience of household head or spouse mortality, a stratification by a household's family structure (Table 39) showed evidence of differing family structure specific rate ratios (p<0.001). Evidence of the higher rates of dissolution in households with a household head or spouse death relative to those without was observed for all the family structures. The rate ratios were highest in the skip generation households (rate ratio=33.9) and single man household (rate ratio=17.6). However, the rate ratios were least for households with an

unmarried woman residing with children (rate ratio=5.2); or with a married woman with (rate ratio=4.8) or without children (rate ratio=4.1).

It would be obvious that a death in a single person household would automatically result in the dissolution of the household. However, as shown by the rates, some households did not dissolve. This is true for the households that either migrated or moved to an unknown location just before the death (a death during the same follow-up period the movement occurred). This results in the household not being reported as a dissolved household as it is unknown whether the household continued to exist when it relocated.

5.6.5.4 Mortality, migration

Alternatively, there was evidence of the differing family structure specific rates ratios of migration ($p<0.001$). Specifically, there was evidence of the rates of migration higher in the households with a death of the household head or spouse relative to those without among households:

- with single parents with children (male parent: rate ratio=3.0, $p<0.001$; female parent: rate ratio=3.3, $p<0.001$);
- with a married couple with children (rate ratio=1.9, $p<0.001$); and
- those extended upwards and downwards (rate ratio=3.6, $p=0.001$).

However, evidence of the rates lower in the households with a death was among single male person households (rate ratio=0.2, $p=0.003$).

5.6.6 Summarising household survival by experience of HIV infection and mortality

In summary, this chapter has showed long-term household survival is most disrupted if the HIV-positive resident is the household head or spouse with the households 1.5 times more likely to migrate as to dissolve. This shows households tending to stay together during the course of the HIV illness. However, the migration could be attributed to the relocation to better health services and HIV care, closeness to support from relative or leaving due to stigma related situations.

Higher migration rates in response to household head or spouse HIV infection were experienced by the households that would have initially been described as stable (with low tendencies of either migration or dissolution). These are specifically households with a married couple living with their children and extended households or households where a child is living with both a middle-aged man and woman with or without an older adult. This could be related to their initially stable tendencies enabling the capability of the residents to move together.

Other households that were likely to migrate were initially likely to dissolve in the absence of HIV. These are single female parent households or households with a child and middle-aged man living together. Households with a married couple with no children maintained their tendencies to migrate overall or with an experience of household head or spouse HIV infection.

If, however, the head or spouse died, the households became 1.4 times more likely to dissolve than to migrate. In addition, the household dissolution was more likely if the deceased head was female or middle-aged. Further, with a death reported commonly among the older residents, their death mostly related to household dissolution when the surviving productive (middle-aged) residents dispersed to other location (commonly for employment purposes) and the dependents were absorbed in other households. This was observed in households with a skip generational structure, single parent households and those with a child, middle-aged and older adult living together.

The investigation also showed dissolution more among those with one death in comparison to multiple deaths over a 4 to 5 year FP. Although multiple deaths would weaken a household's staying together, the findings in this study could imply that a household staying together after the first death could strengthen the ability of the household to stay together after additional experiences of adult deaths.

Overall, an experience of a death weakened the household's ability to stay together. This was depicted by increased household tendencies to dissolve but in turn reduced the the tendency

to migrate. However, there was no evidence that the number of deaths had an impact on the household dissolution tendencies.

In general, household resident HIV infection showed household members staying together either in the same location or migrating elsewhere among the initially stable households. However, a death in the household weakened the ability of the residents to stay together. The residents were either absorbed in other households or some started their own households elsewhere.

In conclusion, it is clear that the findings of this chapter so far go beyond what I stated in my hypotheses in addition to agreeing with the hypotheses that:

- households with a young adult and children are more likely to lose the children or fully dissolve
- single female parent households were likely to migrate
- single male parent households were likely to dissolve

Since these hypotheses were based on findings by other researchers, this shows that the findings in this chapter provide even more detail to what other researchers have observed.

5.7 Effect of adult HIV infection and mortality on the structure of the GPC households over time

Not all households dissolve or migrate after an experience of adult HIV infection and/or mortality. This section mainly looks at structural change in households that survive during or after the infection and death experience. The baseline structure of the household is identified and structural change observed over a LFP. The effect of adult HIV-infection and mortality in the household are investigated separately to reveal any differences. The adults under consideration are the household head, his/her spouse and other middle-aged adult residents aged 15-59. Due to the small number of households that survive, particularly after an adult death among less common household types, this investigation only considers the common household types. First, household change over time is considered according to age and sex composition typology and then according to family structure.

5.7.1 Structural change by age-sex distribution

Structural change in the following households is investigated according to their experience of adult HIV infection or mortality:

- children + middle-aged female adults + middle-aged male adults, no older adults
- middle-aged adults only
- children + middle-aged female adults, no older adults
- children + middle-aged female adults + middle-aged male adults + older adults
- children + middle-aged female adults + older adults
- children + middle-aged male adults, no older adults
- children + middle-aged male adults + older adults

5.7.1.1 Children + middle-aged female adults + middle-aged male adults, no older adults

The structural behaviour of households with this structure at baseline is summarised in Table 40, showing strong evidence of a change in structure in response to adult resident HIV infection or mortality.

Survival

A high survival of 81.7% of the households was among the households with no experience of adult HIV infection or mortality with low dissolution (2.2%) and moderately high migration (11.5%). The experience of adult infection reduced the survival for household head (78.9%) and spouse (69.6%) infection, but an increase in survival for other adult infection (91.3%). Household head and spouse infection corresponded to an increase in migration (15.7% after head infection and 17.6% of spouse infection). The experience of adult mortality reduced survival even more for those that experienced household head death (49%) with not much change after a spouse death (83.3%) and increase in survival after other adult death (94.7%).

Baseline structure at the end of LFP

A high percentage (81.8%) of the surviving households with no experience of adult HIV infection or mortality had this baseline structure at the end of the LFP. However, this survival reduced after the experience of adult HIV infection: 75.4% that experienced household head infection, 75.9% that experienced spouse infection and 71.1% that experienced other adult HIV infection. This reduction was much more after an experience of adult mortality: 51% that experienced a household head death, 50% that experienced a spouse death; and 68.7% that experienced other adult death.

Change in structure

With no experience of adult HIV infection and no adult mortality, 18.2% of the households change to other structures with the common changes to structures with the following living together:

- Child, middle-aged woman, middle-aged woman and older adult (5.3%)
- Only young adults (4%)
- Child and middle-aged woman (3.6%)
- Child and middle-aged man (1.5%)

In comparison to the households with no adult HIV infection or mortality, the experience of household head infection corresponded to a higher loss of children to households with only young adult residents (4% among those with no adult HIV infection or mortality to 10.3% among those with household head HIV infection) or loss of the middle-aged men to one with only child and middle-aged woman residents (3.6% to 7.8%). Spouse infection resulted to a higher loss of children to households with only young adult residents (4% to 10.3%) or the gain of older adults to a structure with a child, middle-aged man, middle-aged woman and older adult resident (5.3% to 6.9%). Other adult infection resulted in a higher gain of older adults to a structure with a child, middle-aged man, middle-aged woman and older adult resident (5.3% to 12.1%).

The experience of household head death mainly resulted in a higher loss of the middle-aged men to a structure with only child and middle-aged woman residents (3.6% to 34.4%); spouse death to a higher loss of the middle-aged women to a structure with only child and middle-aged man residents (1.5% to 27.5%); and other adult death to a higher gain of older adults to a structure with a child, middle-aged man, middle-aged woman and older adult resident (5.3% to 15.7%).

Table 40: Structural change in households of a 'children + middle-aged female adults + middle-aged male adults, no older adults' age-sex distribution at baseline

Households with a '**Children + Middle-aged female adults + Middle-aged male adults, no older adults**' age-sex distribution at baseline	Households observed for 4 or 5 year follow-up periods									
			Households with adult HIV infection and no adult death				Households that experience an adult death			
	All households	**Households with no adult HIV infection and no adult mortality**	**All households**	**HIV+ Head**	**HIV spouse (Head HIV status negative or unknown)**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Spouse death (head alive)**	**Other adult death (Head and Spouse alive)**
Children only	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.0	0.0
Middle-aged adults only	**4.7**	**4.0**	**7.3**	**10.3**	**10.3**	3.0	6.7	8.3	**11.3**	4.0
Older adults only	0.1	0.1	0.2	0.0	1.1	0.0	0.3	0.0	0.0	0.5
Children + Middle-aged female adults, no older adults	**4.5**	**3.6**	5.1	**7.8**	0.0	4.3	11.8	**34.4**	0.0	5.6
Children + Middle-aged female adults + Middle-aged male adults, no older adults	**78.7**	**81.8**	**73.7**	**75.4**	**75.9**	**71.1**	**60.2**	**51.0**	**50.0**	**68.7**
Children + Middle-aged male adults, no older adults	2.2	1.5	2.5	3.9	3.4	0.9	7.0	0.0	**27.5**	2.0
Children + Older adults only	0.5	0.5	0.4	0.4	0.0	0.4	0.3	0.0	0.0	0.5
Children + Middle-aged female adults + older adults	2.1	2.1	2.5	0.0	1.1	5.6	1.3	1.0	0.0	2.0
Children + Middle-aged female adults + Middle-aged male adults + older adults	**6.0**	**5.3**	**7.1**	2.2	**6.9**	**12.1**	10.2	3.1	5.0	**15.7**
Children + Middle-aged male adults + older adults	0.8	0.8	0.4	0.0	0.0	0.9	1.9	1.0	5.0	1.0
Middle-aged adults + Older adults, No children	0.4	0.4	0.9	0.0	1.1	1.7	0.3	0.0	1.2	0.0
Number of surviving households	3,990	3,065	551	232	87	232	374	96	80	198
Total number of households	4,928	3,754	673	294	125	254	501	196	96	209
Percentage that survive	**81.0**	**81.7**	**81.9**	**78.9**	**69.6**	**91.3**	**74.7**	**49.0**	**83.3**	**94.7**
Percentage that dissolve	2.8	2.2	2.1	2.4	4.8	0.4	8.8	**19.9**	1.0	1.9
Percentage that migrate	**11.8**	**11.5**	**12.5**	**15.7**	**17.6**	6.3	**13.4**	**26.0**	**11.5**	2.4
Percentage that are lost to follow-up	4.4	4.7	3.6	3.1	8.0	2.0	3.2	5.1	4.2	1.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			**0.001**	**< 0.001**	**0.002**	**< 0.001**	**< 0.001**	**< 0.001**	**< 0.001**	**< 0.001**

5.7.1.2 Middle-aged adults only

The structural behaviour of households with this structure at baseline is summarised in Table 41. Among the households with no adult HIV infection or mortality, a moderately low percentage of 54.6% survived to the end of the LFP with 29.8% migrating. Among those that survived, 47.7% had the same structure at the end of the LFP while 35.2% gained a child (with the middle-aged man, middle-aged woman and child living together).

A comparison with the households that experienced either adult HIV infection or mortality showed strong evidence of a change in structure in response to spouse HIV infection (p-value=0.014) and weak evidence in response to other adult HIV infection (p=0.062) or household head death (p=0.093) in relation to those that experienced no adult HIV infection or mortality.

Spouse HIV infection resulted in much change from the baseline structure with a higher gain of children to a structure with a child, middle-aged woman and middle-aged man living together (35.2% among those with no adult HIV infection or mortality to 72.7% among those that experienced spouse HIV infection).

Alternatively, a death of the household head led to a greatly reduced household survival (from 54.6% for no experience of adult HIV infection or mortality to 7% after an experience of household head death), resulting from higher dissolution (9.5% to 77.9%).

Other HIV infection corresponded to a higher gain of children and or older adults to households with child and middle-aged woman (4.3% to 9.1%), or one with a child, middle-aged woman, middle-aged woman and older adults (0.6% to 9.1%).

Table 41: Structural change in households of a 'middle-aged adults only' age-sex distribution at baseline

Households with a '**Middle-aged adults only**' age-sex distribution at baseline	Households observed for 4 or 5 year follow-up periods									
			Households with adult HIV infection and no adult death				Households that experience an adult death			
	All households	Households with no adult HIV infection and no adult mortality	All households	HIV+ Head	HIV spouse (Head HIV status negative or unknown)	HIV+ adult (HIV status of head and spouse negative or unknown)	All households	Head death	Spouse death (head alive)	Other adult death (Head and Spouse alive)
Children only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle-aged adults only	**47.0**	**47.7**	**46.0**	**53.8**	**22.7**	**40.9**	**36.1**	0.0	**50.0**	**38.7**
Older adults only	5.2	5.5	2.4	1.2	0.0	9.1	6.4	0.0	10.0	6.4
Children + Middle-aged female adults, no older adults	4.6	4.3	4.8	5.0	0.0	9.1	8.5	**66.7**	0.0	0.0
Children + Middle-aged female adults + Middle-aged male adults, no older adults	**35.5**	**35.2**	**37.9**	**31.3**	**72.7**	**27.3**	**34.0**	**33.4**	**30.0**	**35.5**
Children + Middle-aged male adults, no older adults	2.2	1.9	4.0	5.0	4.5	0.0	2.1	0.0	10.0	0.0
Children + Older adults only	1.4	1.4	0.8	0.0	0.0	4.5	4.3	0.0	0.0	6.4
Children + Middle-aged female adults + older adults	1.2	1.3	0.0	0.0	0.0	0.0	4.3	0.0	0.0	6.4
Children + Middle-aged female adults + Middle-aged male adults + older adults	0.8	0.6	1.6	0.0	0.0	9.1	2.1	0.0	0.0	3.2
Children + Middle-aged male adults + older adults	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle-aged adults + Older adults, No children	1.7	1.6	2.4	3.7	0.0	0.0	2.1	0.0	0.0	3.2
Number of surviving households	967	796	124	80	22	22	47	6	10	31
Total number of households	1,819	1,457	224	156	34	34	138	86	17	35
Percentage that survive	53.2	54.6	55.4	51.3	64.7	64.7	34.1	7.0	58.8	88.6
Percentage that dissolve	**12.8**	9.5	**10.3**	**13.5**	2.9	2.9	**52.2**	**77.9**	**23.5**	2.9
Percentage that migrate	**28.1**	**29.8**	**28.6**	**29.5**	**26.5**	**26.5**	9.4	10.5	**11.8**	5.7
Percentage that are lost to follow-up	5.9	6.1	5.8	5.8	5.9	5.9	4.4	4.7	5.9	2.9
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.166	0.178	**0.014**	**0.062**	0.436	**0.093**	0.345	0.150

5.7.1.3 Children + middle-aged female adults, no older adults

The structural behaviour of households with this structure at baseline is summarised in Table 42. Among the households that experienced no adult HIV infection or mortality, a moderately low percentage survived to the end of the LFP (60.3%), mainly due to a migration of 21.7% of the households.

A comparison to those that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to other adult (not head) HIV infection (p-value=0.009) or other adult death (p=0.033) in relation to those that experienced no adult HIV infection or mortality.

Survival in households with no experience of adult HIV infection or mortality was moderate (60.3%). However, this survival increased to 81.8% in relation to the HIV infection of the other adult and 78.6% in relation to other adult death. In addition, other adult HIV infection resulted in an increased gain of older adults (7.5% of those with no evidence of adult HIV infection or mortality to 25% of those with experience of other adult HIV infection) and/or middle-aged men (2.7% to 13.9%). However, other adult death resulted in an increased gain of both older adults and middle-aged men (2.7% to 9.1%).

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Table 42: Structural change in households of a 'children + middle-aged female adults, no older adults' age-sex distribution at baseline

Households with a **'Children + Middle-aged female adults, no older adults'** age-sex distribution at baseline	**Households observed for 4 or 5 year follow-up periods**							
			Households with adult HIV infection and			**Households that experience an adult death**		
	All households	**Households with no adult HIV infection and no adult mortality**	**All households**	**HIV+ Head**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Other adult death (Head and Spouse alive)**
Children only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle-aged adults only	6.7	7.5	4.4	5.4	2.8	3.7	0.0	4.5
Older adults only	0.8	0.7	0.0	0.0	0.0	3.7	0.0	4.5
Children + Middle-aged female adults, no older adults	**49.2**	**49.9**	**47.8**	**60.7**	**27.8**	**44.4**	**66.5**	**36.4**
Children + Middle-aged female adults + Middle-aged male adults, no older adults	**25.8**	**24.7**	**29.3**	**32.1**	**25.0**	**29.6**	**33.3**	**31.8**
Children + Middle-aged male adults, no older adults	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Children + Older adults only	3.5	3.7	1.1	0.0	2.8	7.4	0.0	9.1
Children + Middle-aged female adults + older adults	7.9	7.5	10.9	1.8	**25.0**	3.7	0.0	4.5
Children + Middle-aged female adults + Middle-aged male adults + older adults	3.5	2.7	5.4	0.0	**13.9**	7.4	0.0	9.1
Children + Middle-aged male adults + older adults	1.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Middle-aged adults + Older adults, No children	1.3	1.5	1.1	0.0	2.8	0.0	0.0	0.0
Number of surviving households	520	401	92	56	36	27	3	22
Total number of households	892	665	143	97	44	84	54	28
Percentage that survive	58.3	**60.3**	**64.3**	**57.7**	**81.8**	**32.2**	5.6	**78.6**
Percentage that dissolve	**14.0**	**13.1**	7.7	7.2	9.1	**32.1**	**44.4**	**10.7**
Percentage that migrate	**23.3**	**21.7**	**25.9**	**32.0**	9.1	**32.1**	**44.4**	**10.7**
Percentage that are lost to follow-up	4.4	5.0	2.1	3.1	0.0	3.6	5.6	0.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.498	0.136	**0.009**	0.119	0.742	**0.033**

5.7.1.4 Children + middle-aged female adults + middle-aged male adults + older adults

The structural behaviour of households with this structure at baseline is summarised in Table 43. Households that experienced no adult HIV infection or mortality had a high survival of 87.8% of the households. Of the surviving households, 49.3% had the baseline structure at the end of the LFP with 18.4% losing the middle-aged man and 11.8% losing the older adult.

Comparing with the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to household head HIV infection (p-value<0.001), household head death (p=0.001) or other adult death (p=0.004) in reference to the households that experienced no adult HIV infection or mortality.

Household head HIV infection resulted in lower survival (87.8% among households with no experience of adult HIV infection or mortality to 64.3% among those that experienced household head HIV infection), corresponding to higher household migration (4.7% to 28.6%). In addition, the infection corresponded to the loss of the older adult residents (11.4% to 44.4%) or an additional loss of the middle-aged man resident (2.5% to 11.1%).

A household head death resulted in lower survival (87.8% to 69%) corresponding to higher household dissolution (4% to 17.2%) and higher migration (4.7% to 10.3%). The death also corresponded to a loss of the older adult residents (11.4% to 25%) or an additional loss of the middle-aged man resident (2.5% to 15%).

Further, the death of the other adults resulted in more household survival (87.8% to 97.8%) and higher maintenance of the baseline structure (49.3% to 63.3%).

Table 43: Structural change in households of a 'children + middle-aged female adults + middle-aged male adults + older adults' age-sex distribution at baseline

Households with a **'Children + Middle-aged female adults + Middle-aged male adults + older adults'** age-sex distribution at baseline	Households observed for 4 or 5 year follow-up periods									
			Households with adult HIV infection and no adult death				Households that experience an adult death			
	All households	**Households with no adult HIV infection and no adult mortality**	**All households**	**HIV+ Head**	**HIV spouse (Head HIV status negative or unknown)**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Spouse death (head alive)**	**Other adult death (Head and Spouse alive)**
Children only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle-aged adults only	1.0	1.0	0.7	0.0	0.0	0.8	1.6	5.0	0.0	1.1
Older adults only	1.6	1.7	2.1	0.0	0.0	2.3	0.8	0.0	0.0	1.1
Children + Middle-aged female adults, no older adults	2.4	2.5	2.1	11.1	0.0	1.6	2.4	**15.0**	0.0	0.0
Children + Middle-aged female adults + Middle-aged male adults, no older adults	**10.1**	**11.4**	7.6	**44.4**	0.0	5.4	7.3	**25.0**	0.0	4.4
Children + Middle-aged male adults, no older adults	0.4	0.2	0.7	**11.1**	0.0	0.0	0.8	5.0	0.0	0.0
Children + Older adults only	3.6	3.5	4.1	0.0	0.0	4.7	3.2	0.0	**21.4**	1.1
Children + Middle-aged female adults + older adults	**18.1**	**18.4**	**18.6**	**11.1**	0.0	**20.2**	**16.1**	**10.0**	**21.4**	**16.7**
Children + Middle-aged female adults + Middle-aged male adults + older adults	**50.5**	**49.3**	**50.3**	**22.2**	**85.7**	**50.4**	**56.5**	**35.0**	**42.9**	**63.3**
Children + Middle-aged male adults + older adults	6.9	7.0	8.3	0.0	0.0	9.3	4.8	0.0	7.1	5.6
Middle-aged adults + Older adults, No children	5.3	5.0	5.5	0.0	**14.3**	5.4	6.5	5.0	7.1	6.7
Number of surviving households	867	598	145	9	7	129	124	20	14	90
Total number of households	981	681	161	14	10	137	139	29	18	92
Percentage that survive	88.4	87.8	90.1	64.3	70.0	94.2	89.2	69.0	77.8	97.8
Percentage that dissolve	3.9	4.0	2.5	7.1	0.0	2.2	5.0	**17.2**	5.6	1.1
Percentage that migrate	4.8	4.7	5.6	**28.6**	**30.0**	1.5	4.3	**10.3**	**11.1**	1.1
Percentage that are lost to follow-up	3.0	3.5	1.9	0.0	0.0	2.2	1.4	3.5	5.6	0.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.650	**< 0.001**	0.664	0.543	**0.005**	**0.001**	0.394	**0.004**

5.7.1.5 Children + middle-aged female adults + older adults

The structural behaviour of households with this structure at baseline is summarised in Table 44. Households that experienced no adult HIV infection or mortality had a high survival of 85.2% of the households. Of those that survived, the highest percentage of the households either maintained the baseline structure (37.1%) or gained a middle-aged man (28.1%). A comparison to the households that experienced no adult HIV infection or mortality, observed was weak evidence of a change in structure in response to other adult (not head or spouse) HIV infection (p-value=0.072), and strong evidence in response to spouse ($p<0.001$) or other adult death ($p=0.028$) in reference to the households that experienced no adult HIV infection or mortality.

The other adult HIV infection resulted mainly in higher survival than that of the households that experienced no adult HIV infection or mortality (85.2% among those with no adult HIV infection or mortality to 94.5% with an HIV-positive other adult) with a higher percentage of households gaining a middle-aged man (28% to 31.9%).

Spouse death resulted in higher household migration (6.1% to 15.4%) and no dissolution (4.9% to 0%). Among those that survived, there was a higher loss of children (10% to 30%) or higher loss of older adults but a gain in middle-aged men (4.5% to 40%). Alternatively, other adult death resulted in lower household migration (6.1% to 3.1%) and among those that survived, a higher loss of children (10% to 16.1%).

Table 44: Structural change in households of a 'children + middle-aged female adults + older adults' age-sex distribution at baseline

Households with a '**Children + Middle-aged female adults + older adults**' age-sex distribution at baseline	Households observed for 4 or 5 year follow-up periods									
	All households	Households with no adult HIV infection and no adult mortality	Households with adult HIV infection and no adult death				Households that experience an adult death			
			All households	HIV+ Head	HIV spouse (Head HIV status negative or unknown)	HIV+ adult (HIV status of head and spouse negative or unknown)	All households	Head death	Spouse death (head alive)	Other adult death (Head and Spouse alive)
Children only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle-aged adults only	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Older adults only	3.0	2.1	4.0	0.0	0.0	4.3	9.1	0.0	**40.0**	0.0
Children + Middle-aged female adults, no older adults	5.2	5.7	2.7	**25.0**	0.0	1.4	4.5	**33.3**	0.0	3.2
Children + Middle-aged female adults + Middle-aged male adults, no older adults	4.6	4.5	5.3	**25.0**	0.0	4.3	4.5	**33.3**	0.0	3.2
Children + Middle-aged male adults, no older adults	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Children + Older adults only	**8.5**	8.3	9.3	**25.0**	0.0	8.7	9.1	0.0	10.0	9.7
Children + Middle-aged female adults + older adults	**37.4**	**37.1**	**42.7**	**25.0**	**50.0**	**43.5**	**31.8**	0.0	10.0	**41.9**
Children + Middle-aged female adults + Middle-aged male adults + older adults	**27.4**	**28.0**	**29.3**	0.0	0.0	**31.9**	**18.2**	**33.3**	10.0	**19.4**
Children + Middle-aged male adults + older adults	3.9	3.8	4.0	0.0	0.0	4.3	4.5	0.0	0.0	6.5
Middle-aged adults + Older adults, No children	**9.6**	**10.0**	2.7	0.0	**50.0**	1.4	**18.2**	0.0	**30.0**	**16.1**
Number of surviving households	540	421	75	4	2	69	44	3	10	31
Total number of households	624	494	79	4	2	73	51	6	13	32
Percentage that survive	**86.5**	**85.2**	**94.9**	**100.0**	**100.0**	**94.5**	**86.3**	**50.0**	**76.9**	**96.9**
Percentage that dissolve	4.2	4.9	1.3	0.0	0.0	1.4	2.0	**16.7**	0.0	0.0
Percentage that migrate	5.8	6.1	3.8	0.0	0.0	4.1	5.9	0.0	**15.4**	3.1
Percentage that are lost to follow-up	3.5	3.9	0.0	0.0	0.0	0.0	5.9	**33.3**	7.7	0.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.144	0.514	0.911	**0.072**	**0.014**	0.550	**< 0.001**	**0.028**

5.7.1.6 Children + middle-aged male adults, no older adults

The structural behaviour of households with this structure at baseline is summarised in Table 45. The households that experienced no adult HIV infection or mortality had a moderately high survival of 63.8% of the household while 23% migrated. Of those that survived the majority of the households gained a middle-aged woman (41.2%), 23.7% maintained the baseline structure and 23.7% lost the child.

A comparison with the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to household head death ($p=0.003$) in reference to the households that experienced no adult HIV infection or mortality. Household head death resulted in lower survival in relation to those with no adult HIV infection or death (63.6% to 20%) with more dissolution (3.7% to 46.7%). In addition, there was a reduced gain of middle-aged women (41.2% to 0%) and a higher loss of middle-aged men (0% to 33.4%).

Table 45: Structural change in households of a 'children + middle-aged male adults, no older adults' age-sex distribution at baseline

Households with a '**Children + Middle-aged male adults, no older adults**' age-sex distribution at baseline	Households observed for 4 or 5 year follow-up periods							
			Households with adult HIV infection and			Households that experience an adult death		
	All households	**Households with no adult HIV infection and no adult mortality**	**All households**	**HIV+ Head**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Other adult death (Head and Spouse alive)**
Children only	0.8	0.0	0.0	0.0	0.0	**16.7**	**33.4**	0.0
Middle-aged adults only	**24.4**	**23.7**	**28.6**	**30.0**	**33.3**	**16.7**	**33.4**	0.0
Older adults only	1.5	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Children + Middle-aged female adults, no older adults	**21.4**	**23.7**	**14.3**	**20.0**	0.0	**16.7**	**33.4**	0.0
Children + Middle-aged female adults + Middle-aged male adults, no older adults	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Children + Middle-aged male adults, no older adults	**43.5**	**41.2**	**53.6**	**45.0**	**66.7**	**33.3**	0.0	**66.7**
Children + Older adults only	2.3	3.1	0.0	0.0	0.0	0.0	0.0	0.0
Children + Middle-aged female adults + older adults	0.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Children + Middle-aged female adults + Middle-aged male adults + older adults	4.6	5.2	0.0	0.0	0.0	**16.7**	0.0	**33.3**
Children + Middle-aged male adults + older adults	0.8	0.0	3.6	5.0	0.0	0.0	0.0	0.0
Middle-aged adults + Older adults, No children	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of surviving households	131	97	28	20	3	6	3	3
Total number of households	208	152	37	27	3	19	15	4
Percentage that survive	63.0	63.8	75.7	74.1	100.0	31.6	20.0	75.0
Percentage that dissolve	9.6	7.9	2.7	3.7	0.0	**36.8**	**46.7**	0.0
Percentage that migrate	**22.1**	**23.0**	**16.2**	**18.5**	0.0	**26.3**	**26.7**	**25.0**
Percentage that are lost to follow-up	5.3	5.3	5.4	3.7	0.0	5.3	6.7	0.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.293	0.422	0.999	0.097	**0.003**	0.801

5.7.1.7 Children + middle-aged male adults + older adults

The structural behaviour of households with this structure at baseline is summarised in Table 46. Households that experienced no adult HIV infection or mortality had a high survival of 80.2% of the households. Of those that survived, households either: maintained the same structure (28.8%), gained a middle-aged woman (18.7%), lost the middle-aged man (17.2%), lost the middle-aged man and gained a middle-aged woman (10.4%), or lost the child (14.1%).

A comparison of structural change among those that experienced adult HIV infection or mortality and those that did not showed weak evidence in structure in response to household head HIV infection (p=0.092). With only three households experiencing household head HIV infection, one maintained the same structure; one lost the child; and the other gained a middle-aged woman but lost the older adult.

Table 46: Structural change in households of a 'children + middle-aged male adults + older adults' age-sex distribution at baseline

Households with a '**Children + Middle-aged male adults + older adults**' age-sex distribution at baseline	Households observed for 4 or 5 year follow-up periods									
			Households with adult HIV infection and no adult death				Households that experience an adult death			
	All households	**Households with no adult HIV infection and no adult mortality**	**All households**	**HIV+ Head**	**HIV spouse (Head HIV status negative or unknown)**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Spouse death (head alive)**	**Other adult death (Head and Spouse alive)**
Children only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle-aged adults only	2.5	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Older adults only	7.1	7.4	5.3	0.0	0.0	6.7	6.2	0.0	0.0	7.7
Children + Middle-aged female adults, no older adults	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Children + Middle-aged female adults + Middle-aged male adults, no older adults	2.5	1.8	**10.5**	**33.3**	0.0	6.7	0.0	0.0	0.0	0.0
Children + Middle-aged male adults, no older adults	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Children + Older adults only	**16.7**	**17.2**	**10.5**	0.0	0.0	**13.3**	**18.8**	**50.0**	0.0	**15.4**
Children + Middle-aged female adults + older adults	**10.1**	**10.4**	5.3	0.0	0.0	6.7	**12.5**	0.0	0.0	**15.4**
Children + Middle-aged female adults + Middle-aged male adults + older adults	**18.7**	**16.6**	**21.0**	0.0	**100.0**	**20.0**	**37.5**	**50.0**	**100.0**	**30.8**
Children + Middle-aged male adults + older adults	**27.8**	**28.8**	**21.1**	**33.3**	0.0	**20.0**	**25.0**	0.0	0.0	**30.8**
Middle-aged adults + Older adults, No children	**14.1**	**14.1**	**26.3**	**33.3**	0.0	**26.7**	0.0	0.0	0.0	0.0
Number of surviving households	198	163	19	3	1	15	16	2	1	13
Total number of households	247	200	26	5	1	20	21	7	1	13
Percentage that survive	**80.2**	**81.5**	**73.1**	**60.0**	**100.0**	**75.0**	**76.2**	28.6	**100.0**	**100.0**
Percentage that dissolve	9.3	8.5	**11.5**	**40.0**	0.0	5.0	**14.3**	**42.9**	0.0	0.0
Percentage that migrate	5.7	5.5	**11.5**	0.0	0.0	**15.0**	0.0	0.0	0.0	0.0
Percentage that are lost to follow-up	4.9	4.5	3.9	0.0	0.0	5.0	9.5	**28.6**	0.0	0.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.598	0.092	0.887	0.869	0.174	0.971	0.887	0.173

5.7.2 Family structure

To further investigate structural change in households according to their experience of adult HIV infection or mortality, the responses of households with the following baseline family structures are considered:

- nuclear: head + spouse(s) + biological children
- >2-generational household: downward +/- upward-extended
- head + spouse(s), no biological children
- single parent: female head + biological children
- single parent: male head + biological children
- skip generational household: downward +/- upward vertical extended.

5.7.2.1 Nuclear: head + spouse(s) + biological Children

The structural behaviour of households with this structure at baseline is summarised in Table 47. The households with no adult HIV infection or mortality had a high survival of 82% of the households. A high percentage of the households that survived (78.8%) had the baseline structure at the end of the LFP with 11% of the households changing to an extended structure, extended downwards and/or upwards.

Comparing with the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to adult (whether head, spouse or other adult) HIV infection or mortality ($p<0.005$) in reference to the households that experienced no adult HIV infection or mortality with the exception of other adult HIV infection that showed weak evidence ($p=0.057$).

Household head HIV infection resulted in lower change to the extended structure (11% among those that experienced no adult HIV infection or mortality to 4.3%) and higher loss of the female parent to a single male parent household (2% to 6.4%). Spouse HIV infection resulted in lower household survival (82% to 68.6%), corresponding to higher household dissolution (11.5% to 18.2%). The surviving households showed a higher loss of the children to a household with a head and spouse (1.5% to 7.2%) or loss of both the children and one

parent to a single person household (2.3% to 6%). Other adult HIV infection resulted in higher survival (82% to 90.2%) with a higher change to an extended structure (downwards and/or upwards: 11% to 20.4%; upwards only: 1.2% to 3.8%).

Household head death resulted in much lower survival (82% to 56.5%) with higher household migration. The households that survived mainly experienced a loss of the male parent resulting in a single female parent household (1.4% to 61.4%). Spouse death resulted in a higher loss of the female parent to a single male parent household (2% to 40.5%). Note the 16.5% that maintained the nuclear structure after a death of a spouse, this was among households where the head had more one spouse. The other adult death resulted in higher survival (82% to 96.5%) and higher change to an extended structure (11% to 27.2%).

Table 47: Structural change in households of a 'nuclear' family structure at baseline

Households with a '**Nuclear: Head + Spouse(s) + Biological Children**' family structure at baseline	**Households observed for 4 or 5 year follow-up periods**									
	All households	**Households with no adult HIV infection and no adult mortality**	**Households with adult HIV infection and no adult death**				**Households that experience an adult death**			
			All households	**HIV+ Head**	**HIV spouse (Head HIV status negative or unknown)**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Spouse death (head alive)**	**Other adult death (Head and Spouse alive)**
Single person/head only	3.0	2.5	4.0	4.3	6.0	2.5	6.0	8.4	8.9	2.9
Head + spouse(s), no biological children	1.8	1.5	2.6	2.1	7.2	0.6	3.4	2.4	2.5	4.4
Nuclear: Head + Spouse(s) + Biological Children	**74.3**	**78.8**	**72.1**	**77.0**	**72.3**	**66.2**	**36.9**	2.4	32.9	**60.3**
Single parent: Male Head + Biological Children	3.4	2.2	4.2	7.5	3.6	0.6	13.1	0.0	45.6	2.2
Single parent: Female Head + Biological Children	3.3	1.6	2.6	3.7	0.0	2.5	**19.1**	**67.5**	0.0	0.7
>2-generational household: Upward extended	1.4	1.2	2.1	0.5	2.4	3.8	1.3	1.2	3.8	0.0
>2-generational household: Downward +/- Upward extended	**11.7**	**11.0**	**11.0**	4.3	8.4	**20.4**	**18.8**	**16.9**	6.3	**27.2**
Head + Parent, No biological children	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skip generational household: Downward +/- Upward	0.9	0.9	1.2	0.5	0.0	2.5	1.0	1.2	0.0	1.5
Sibling only	0.2	0.2	0.2	0.0	0.0	0.6	0.3	0.0	0.0	0.7
Number of surviving households	3,398	2,673	427	187	83	157	298	83	79	136
Total number of households	4,177	3,260	530	235	121	174	387	147	99	141
Percentage that survive	**81.4**	**82.0**	**80.6**	**79.6**	68.6	**90.2**	**77.0**	**56.5**	79.8	**96.5**
Percentage that dissolve	2.2	1.7	2.3	2.1	5.0	0.6	5.7	12.2	2.0	1.4
Percentage that migrate	**11.9**	**11.5**	**13.0**	**15.7**	18.2	5.7	**13.4**	**25.2**	13.1	1.4
Percentage that are lost to follow-up	4.6	4.8	4.2	2.6	8.3	3.4	3.9	6.1	5.1	0.7
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			**0.007**	**< 0.001**	**0.004**	**0.057**	**< 0.001**	**< 0.001**	**< 0.001**	**0.001**

5.7.2.2 >2-generational household: downward +/- upward extended

The structural behaviour of households with this structure at baseline is summarised in Table 48. The households that experienced no adult HIV infection or mortality had a high survival of 89.1% of the households. The surviving households mainly had the baseline structure at the end of the LFP (65.5%), 18.2% changed to a skip generational, and 7.1% to a nuclear structure.

A comparison to the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to head death ($p<0.001$), and other adult death ($p=0.020$) and weak evidence in response to other adult HIV infection ($p=0.086$) in reference to the households that experienced no adult HIV infection or mortality.

With no evidence of difference, spouse HIV infection corresponded to fewer households having the baseline structure at the end of the LFP (65.5% to 40%) and more change to the nuclear structure (4.5% to 30%). However, with weak evidence of a difference, other adult HIV infection resulted in higher survival (89.1% to 95.7%).

Household head death resulted in less survival (89.1% to 57.7%) with higher dissolution (2.9% to 17.3%) and migration (4.7% to 11.5%). Fewer surviving households after a death of the household head had the same structure at the end of the LFP (65.5% to 45.2%), with an increased change to a single female parent (3.3% to 20%) or single person household (2.3% to 13.3%). Other adult death resulted in higher survival (89.1% to 96.8%).

Table 48: Structural change in households of a '>2 generational: downwards and/or upward extended' family structure at baseline

Households with a '**>2-generational household: Downward +/- Upward extended**' family structure at baseline	Households observed for 4 or 5 year follow-up periods									
	All households	Households with no adult HIV infection and no adult mortality	Households with adult HIV infection and no adult death				Households that experience an adult death			
			All households	HIV+ Head	HIV spouse (Head HIV status negative or unknown)	HIV+ adult (HIV status of head and spouse negative or unknown)	All households	Head death	Spouse death (head alive)	Other adult death (Head and Spouse alive)
Single person/head only	2.7	2.5	2.4	0.0	10.0	2.2	4.1	**16.1**	11.8	0.7
Head + spouse(s), no biological children	0.6	0.7	0.4	0.0	10.0	0.0	0.5	0.0	0.0	0.7
Nuclear: Head + Spouse(s) + Biological Children	5.9	7.1	3.9	4.5	**30.0**	2.7	2.0	0.0	0.0	2.7
Single parent: Male Head + Biological Children	1.4	1.4	2.0	0.0	0.0	2.2	1.0	3.2	5.9	0.0
Single parent: Female Head + Biological Children	4.3	4.1	3.1	9.1	0.0	2.7	7.1	**19.4**	0.0	5.4
>2-generational household: Upward extended	0.3	0.3	0.4	0.0	0.0	0.4	0.5	3.2	0.0	0.0
>2-generational household: Downward +/- Upward extended	**65.2**	**65.5**	**65.9**	**72.7**	**40.0**	**66.4**	**62.4**	**45.2**	**41.2**	**68.5**
Head + Parent, No biological children	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skip generational household: Downward +/- Upward	**19.3**	**18.2**	**21.6**	**13.6**	10.0	**22.9**	**21.8**	9.7	41.2	**22.1**
Sibling only	0.3	0.2	0.4	0.0	0.0	0.4	0.5	3.2	0.0	0.0
Number of surviving households	1,485	1,033	255	22	10	223	197	31	17	149
Total number of households	1,660	1,159	274	29	12	233	227	53	20	154
Percentage that survive	**89.5**	**89.1**	**93.1**	**75.9**	**83.3**	**95.7**	**86.8**	**58.5**	**85.0**	**96.8**
Percentage that dissolve	3.0	2.9	1.5	6.9	0.0	0.9	4.8	**17.0**	0.0	1.3
Percentage that migrate	4.6	4.7	4.4	**13.8**	**16.7**	2.6	4.4	**11.3**	10.0	1.3
Percentage that are lost to follow-up	3.0	3.3	1.1	3.4	0.0	0.9	4.0	13.2	5.0	0.6
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.133	0.955	0.563	**0.086**	**0.044**	**< 0.001**	0.282	**0.020**

5.7.2.3 Head + spouse(s), no biological children

The structural behaviour of households with this structure at baseline is summarised in Table 49. Households with no adult HIV infection or mortality had a moderately high survival of 74.1% of the households with 16.9% migrating. Of the households that survived, only 18.7% had the baseline structure at the end of the LFP while a much higher percentage (49.6%) had children thus changing to the nuclear structure.

A comparison to the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to household head death ($p<0.001$), and spouse death ($p<0.001$). It also showed weak evidence in response to household head HIV infection ($p=0.093$) in reference to the households that experienced no adult HIV infection or mortality.

Household head HIV infection resulted in reduced survival (74% to 55%) with higher migration (16.9% to 32.5%). Among the surviving households, more had the baseline structure at the end of the LFP (18.7% to 40.9%) and fewer had children to change to the nuclear structure (49.6% to 27.3%). However, with no evidence of a difference, spouse HIV infection resulted in lower survival (74% to 60%) with higher migration (16.9% to 25%).

Household head death resulted in a much lower survival (74% to 38.9%) with higher dissolution (4.1% to 16.7%) and higher migration (16.9% to 27.8%). None of the surviving households had the baseline structure or had children at the end of the LFP but mainly resulted in a single person household (14.6% to 57.1%). Similarly, spouse death also mainly resulted in a change to a single person household (14.6% to 53.8%).

Table 49: Structural change in households of a 'head + spouse(s), no biological children' family structure at baseline

Households with a '**Head + spouse(s), no biological children**' family structure at baseline	**Households observed for 4 or 5 year follow-up periods**							
	All households	**Households with no adult HIV infection and no adult mortality**	**Households with adult HIV infection and no adult death**			**Households that experience an adult death**		
			All households	**HIV+ Head**	**HIV spouse (Head HIV status negative or unknown)**	**All households**	**Head death**	**Spouse death (head alive)**
Single person/head only	**17.6**	**14.6**	**20.0**	**22.7**	**16.7**	**42.9**	**57.1**	**53.8**
Head + spouse(s), no biological children	**19.3**	**18.7**	**27.5**	**40.9**	**16.7**	**14.3**	0.0	0.0
Nuclear: Head + Spouse(s) + Biological Children	**44.9**	**49.6**	**32.5**	**27.3**	**50.0**	**17.9**	0.0	**15.4**
Single parent: Male Head + Biological Children	1.5	0.4	5.0	4.5	8.3	7.1	0.0	**15.4**
Single parent: Female Head + Biological Children	0.3	0.0	0.0	0.0	0.0	3.6	14.3	0.0
>2-generational household: Upward extended	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0
>2-generational household: Downward +/- Upward extended	3.6	3.0	5.0	0.0	8.3	7.1	14.3	7.7
Head + Parent, No biological children	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Skip generational household: Downward +/- Upward	**11.6**	**12.3**	10.0	4.5	0.0	7.1	14.3	7.7
Sibling only	0.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Number of surviving households	336	268	40	22	12	28	7	13
Total number of households	475	362	68	40	20	45	18	18
Percentage that survive	**70.7**	**74.0**	**58.8**	**55.0**	**60.0**	**62.2**	**38.9**	**72.2**
Percentage that dissolve	5.1	4.1	5.9	7.5	5.0	11.1	16.7	11.1
Percentage that migrate	**18.7**	**16.9**	**29.4**	**32.5**	**25.0**	**17.8**	**27.8**	11.1
Percentage that are lost to follow-up	5.5	5.0	5.9	5.0	10.0	8.9	16.7	5.6
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.112	**0.093**	0.305	**< 0.001**	**< 0.001**	**< 0.001**

5.7.2.4 Single parent: female head + biological children

The structural behaviour of households with this structure at baseline is summarised in Table 50. The households that experienced no adult HIV infection or mortality had a moderately high survival (61.6%) with 21.4% of the households migrating. The surviving households mainly had the baseline structure at the end of the LFP (62.1%) or changed to an extended structure (21.2%).

A comparison to the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to household head HIV infection ($p=0.035$), household head death ($p<0.001$) and spouse death ($p=0.004$) in reference to the households that experienced no adult HIV infection or mortality.

Household head death resulted in a much lower household survival (61.6% to 8.8%) with a higher dissolution (12.1% to 35.1%) and higher migration (21.4% to 50.9%). Less of the surviving households had the same structure at the end of the LFP (62.1% to 20%) with a higher change to a single person (6.2% to 40%) or nuclear structure (6.2% to 20%). Other adult death also resulted in a lower percentage having the same structure at the end of the LFP (62.1% to 27.8%) and more changing to the extended structure (21.2% to 44.4%).

Table 50: Structural change in households of a 'single parent: female head + biological children' family structure at baseline

Households with a '**Single parent: Female Head + Biological Children**' family structure at baseline	**Households observed for 4 or 5 year follow-up periods**							
	All households	**Households with no adult HIV infection and no adult mortality**	**Households with adult HIV infection and no adult death**			**Households that experience an adult death**		
			All households	**HIV+ Head**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Other adult death (Head and Spouse alive)**
Single person/head only	6.7	6.2	6.7	7.0	6.1	11.6	**40.0**	8.3
Head + spouse(s), no biological children	0.2	0.0	0.0	0.0	0.0	2.3	0.0	2.8
Nuclear: Head + Spouse(s) + Biological Children	5.2	4.7	7.6	9.9	3.0	4.7	20.0	2.8
Single parent: Male Head + Biological Children	0.4	0.0	1.0	1.4	0.0	2.3	20.0	0.0
Single parent: Female Head + Biological Children	**58.7**	**62.1**	**57.1**	**64.8**	**42.4**	**30.2**	20.0	**27.8**
>2-generational household: Upward extended	1.3	1.0	1.9	1.4	3.0	2.3	0.0	2.8
>2-generational household: Downward +/- Upward extended	**23.3**	**21.2**	**25.7**	**15.5**	**45.5**	**37.2**	0.0	**44.4**
Head + Parent, No biological children	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skip generational household: Downward +/- Upward	3.8	4.2	0.0	0.0	0.0	9.3	0.0	11.1
Sibling only	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Number of surviving households	554	406	105	71	33	43	5	36
Total number of households	921	659	156	112	42	106	57	47
Percentage that survive	**60.2**	**61.6**	**67.3**	**63.4**	**78.6**	**40.6**	8.8	**76.6**
Percentage that dissolve	12.8	12.1	7.7	7.1	9.5	**24.5**	**35.1**	12.8
Percentage that migrate	**22.8**	**21.4**	**22.4**	**25.9**	11.9	**32.1**	**50.9**	10.6
Percentage that are lost to follow-up	4.2	4.9	2.6	3.6	0.0	2.8	5.3	0.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.474	**0.035**	0.582	**0.067**	**< 0.001**	**0.019**

5.7.2.5 Single parent: male head + biological children

The structural behaviour of households with this structure at baseline is summarised in Table 51. The households that experienced no adult HIV infection or mortality had a moderately high survival (67.5%) with 20.7% migrating. The surviving households either had the baseline structure at the end of the LFP (41.3%), changed to the single person (21.9%) or nuclear structure (20%).

A comparison to the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to household head death (p=0.001) in reference to the households that experienced no adult HIV infection or mortality. Household head death specifically resulted in a very low survival (67.5% to 19.0%) with much higher household dissolution (5.9% to 47.6%). The only 4 surviving households either changed to a single person (50%) or sibling only structure (50%).

Table 51: Structural change in households of a 'single parent: male head + biological children' family structure at baseline

Households with a '**Single parent: Male Head + Biological Children**' family structure at baseline	**Households observed for 4 or 5 year follow-up periods**							
	All households	**Households with no adult HIV infection and no adult mortality**	**Households with adult HIV infection and no adult death**			**Households that experience an adult death**		
			All households	**HIV+ Head**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Other adult death (Head and Spouse alive)**
Single person/head only	**22.0**	**21.9**	**19.0**	**18.5**	**30.0**	**31.3**	**50.0**	**25.0**
Head + spouse(s), no biological children	1.4	1.3	2.4	0.0	0.0	0.0	0.0	0.0
Nuclear: Head + Spouse(s) + Biological Children	**22.0**	**21.9**	**26.2**	**29.6**	10.0	12.5	0.0	16.7
Single parent: Male Head + Biological Children	**40.4**	**41.3**	**40.5**	**44.4**	**50.0**	**31.3**	0.0	**41.7**
Single parent: Female Head + Biological Children	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>2-generational household: Upward extended	1.4	1.3	2.4	3.7	0.0	0.0	0.0	0.0
>2-generational household: Downward +/- Upward extended	8.7	9.4	7.1	0.0	10.0	6.3	0.0	8.3
Head + Parent, No biological children	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Skip generational household: Downward +/- Upward	1.8	1.9	0.0	0.0	0.0	6.3	0.0	8.3
Sibling only	1.8	0.6	2.4	3.7	0.0	12.5	**50.0**	0.0
Number of surviving households	218	160	42	27	10	16	4	12
Total number of households	328	237	56	36	14	35	21	14
Percentage that survive	**66.5**	**67.5**	**75.0**	**75.0**	**71.4**	**45.7**	**19.0**	**85.7**
Percentage that dissolve	7.3	5.9	0.0	0.0	0.0	**28.6**	**47.6**	0.0
Percentage that migrate	**20.4**	**20.7**	**17.9**	**19.4**	**21.4**	**22.9**	**33.3**	**7.1**
Percentage that are lost to follow-up	5.8	5.9	7.1	5.6	7.1	2.9	0.0	7.1
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.954	0.535	0.799	0.123	**0.001**	0.930

5.7.2.6 Skip generational household: downward +/- upward vertical extended

The structural behaviour of households with this structure at baseline is summarised in Table 52. The households that experienced no adult HIV infection or mortality had a moderately high survival (74.2%) with 13.2% dissolving and 9.2% migrating. Furthermore, a moderately high percentage of the surviving households had the baseline structure at the end of the LFP (74%) while 10.6% changed to an extended structure and 10.6% to the single person household.

A comparison to the households that experienced adult HIV infection or mortality showed strong evidence of a change in structure in response to other adult HIV infection (p=0.003) in reference to the households that experienced no adult HIV infection or mortality.

With no evidence of a difference, household head HIV infection resulted in higher migration (9.2% to 27.3%) while household head death resulted in higher dissolution (13.2% to 81.3%). Other adult HIV infection or mortality resulted in higher survival (74.2% to 88.1% for HIV infection or 93.2% for mortality) and higher change to the extended structure.

Table 52: Structural change in households of a skip generational family structure at baseline

Households with a '**Skip generational household: Downward +/- Upward vertical extended**' family structure at baseline	**Households observed for 4 or 5 year follow-up periods**									
	All households	**Households with no adult HIV infection and no adult mortality**	**Households with adult HIV infection and no adult death**				**Households that experience an adult death**			
			All households	**HIV+ Head**	**HIV spouse (Head HIV status negative or unknown)**	**HIV+ adult (HIV status of head and spouse negative or unknown)**	**All households**	**Head death**	**Spouse death (head alive)**	**Other adult death (Head and Spouse alive)**
Single person/head only	**10.4**	**10.6**	7.1	0.0	**25.0**	6.8	**14.3**	**50.0**	**50.0**	7.3
Head + spouse(s), no biological children	1.7	1.5	2.4	0.0	0.0	2.7	2.0	0.0	16.7	0.0
Nuclear: Head + Spouse(s) + Biological Children	0.5	0.5	0.0	0.0	0.0	0.0	2.0	0.0	0.0	2.4
Single parent: Male Head + Biological Children	0.3	0.2	1.2	0.0	0.0	1.4	0.0	0.0	0.0	0.0
Single parent: Female Head + Biological Children	1.5	1.5	1.2	0.0	0.0	1.4	2.0	**50.0**	0.0	0.0
>2-generational household: Upward extended	0.1	0.0	1.2	**14.3**	0.0	0.0	0.0	0.0	0.0	0.0
>2-generational household: Downward +/- Upward extended	**13.0**	**10.6**	**27.1**	0.0	**25.0**	**29.7**	**20.4**	0.0	0.0	**24.4**
Head + Parent, No biological children	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skip generational household: Downward +/- Upward	**71.4**	**74.0**	**58.8**	**85.7**	**50.0**	**56.8**	**59.2**	0.0	**33.3**	**65.9**
Sibling only	1.0	1.1	1.2	0.0	0.0	1.4	0.0	0.0	0.0	0.0
Number of surviving households	787	653	85	7	4	74	49	2	6	41
Total number of households	1,045	880	99	11	4	84	66	16	6	44
Percentage that survive	**75.3**	**74.2**	**85.9**	**63.6**	**100.0**	**88.1**	**74.2**	**12.5**	**100.0**	**93.2**
Percentage that dissolve	12.9	13.2	6.1	9.1	0.0	6.0	**19.7**	**81.3**	0.0	0.0
Percentage that migrate	8.8	9.2	7.1	**27.3**	0.0	4.8	6.1	6.3	0.0	6.8
Percentage that are lost to follow-up	3.0	3.4	1.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0
P-Value (comparing with surviving households that experience no adult HIV or adult mortality)			0.007	0.924	0.942	**0.003**	0.930	0.253	0.207	0.804

5.7.3 Summarising structural change

The structural behaviour of households in response to their experience to adult HIV infection or adult mortality and in relation to the position of the adult in the household and the baseline structure of the household is summarised in Figure 40 and Figure 41. To explain the graphical presentation an example of the 'children + middle-aged female adults + middle-aged male adults + older adults' age-sex distribution and the 'nuclear' family structure are used to illustrate what is presented in Figure 40 and Figure 41 respectively.

For households with a 'children + middle-aged female adults + middle-aged male adults + older adults' age-sex distribution at baseline, common changes during the LFP were to the following age-sex distributions:

- 'middle-aged adults' in those that had an HIV-positive head (H_A) or HIV-positive spouse of the households head (H_B);
- 'children + middle-aged female adults, no older adults' in those that had a household head deaths (M_A); and
- 'children + middle-aged female adults + middle-aged male adults + older adults' in those that had an HIV-positive or deceased middle-aged adult (that is not the head or his/her spouse) (H_C , M_C).

For households with a 'nuclear' family structure at baseline, common changes during the LFP were to the following family structures:

- '>2-generational household: downward +/- upward extended' in those that had:
    - no adult HIV-infection or mortality (NE),
    - an HIV-positive spouse of the head with the status of the head negative or unknown (H_B),
    - an HIV-positive middle-aged adult with the status of the head and his/her spouse negative or unknown (H_C), or
    - a death of a middle-aged adult with head and his/her spouse alive (M_C);

- ‘single parent: male head +biological children’ in those that had a death of the spouse of the head with the head alive (M_B)
- ‘single parent: female head +biological children’ in those that had a death of the household head (M_A).

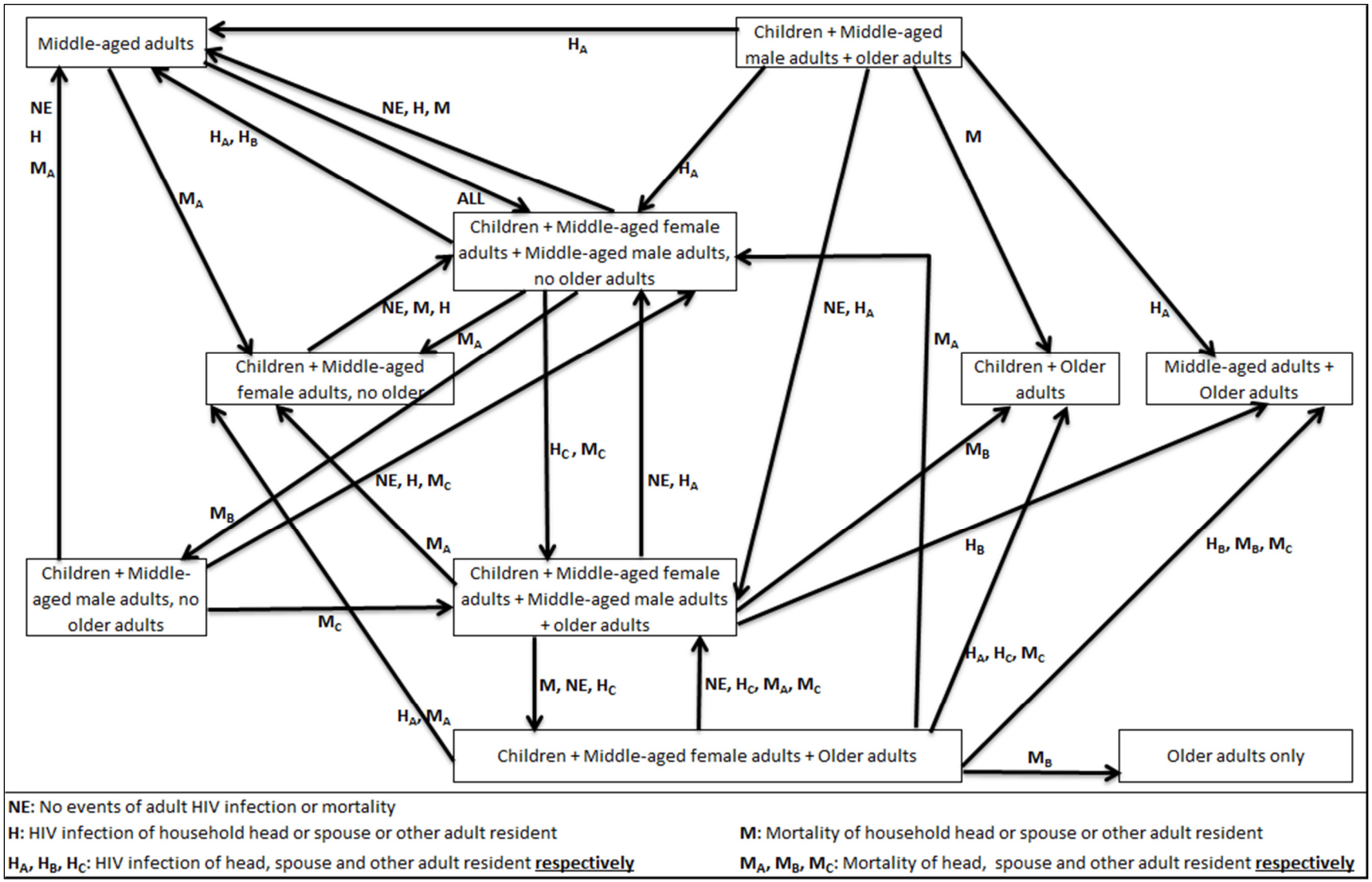

Figure 40: Common changes in the age-sex distribution of household by HIV infection and mortality of the adult household residents

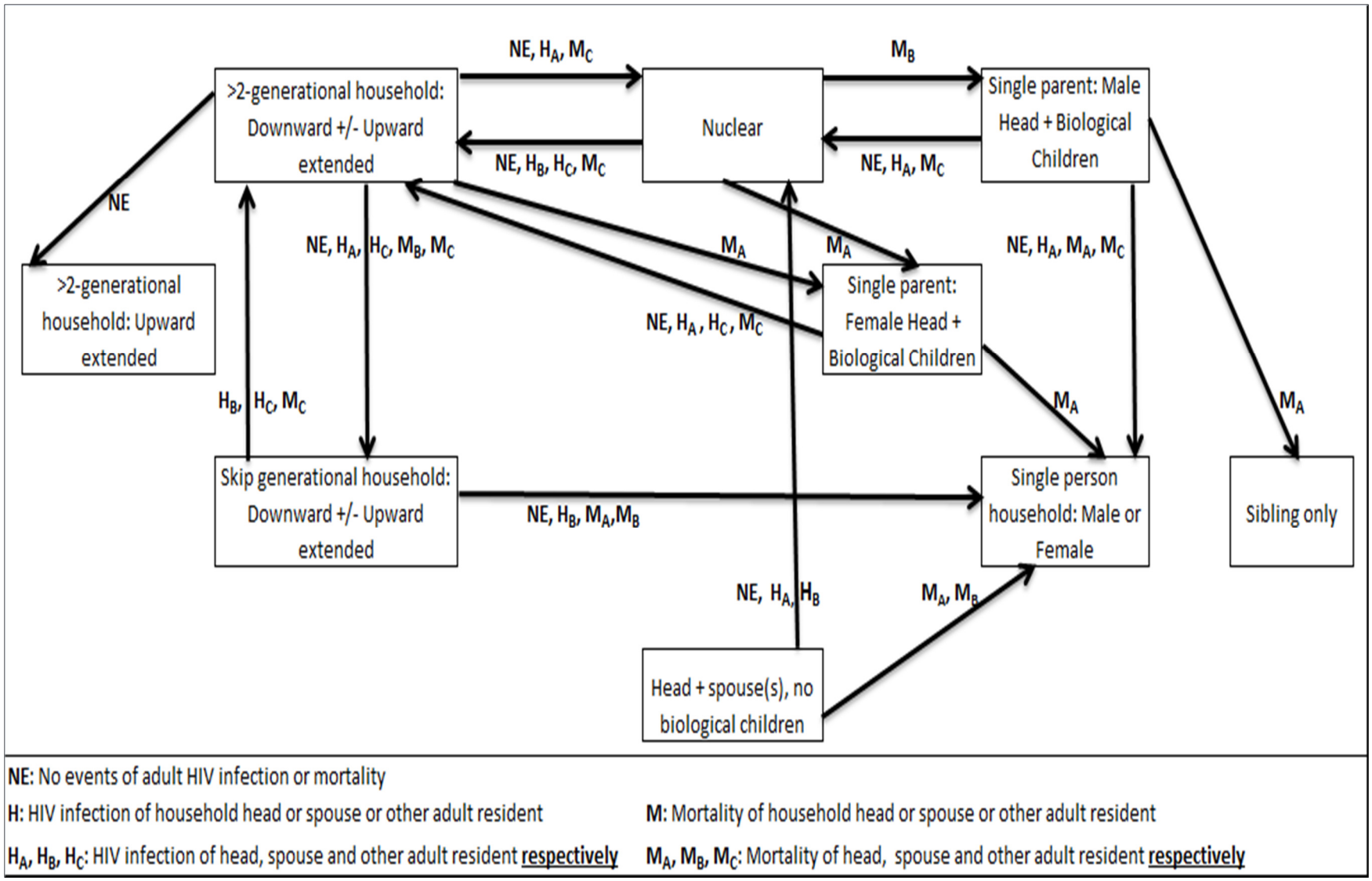

Figure 41: Common changes in the family structure of household by HIV infection and mortality of the adult household residents

The household response to adult HIV infection and adult mortality are further summarised in Table 53. This response shows the experiences that corresponded to particular household member behaviour particularly in the area of household growth, reproduction, marriage, individual migration, household dissolution and household migration.

Table 53: Household structural response to adult HIV infection or adult mortality

<table>
<tr><th>Household head</th><th>Spouse</th><th>Other adult</th></tr>
<tr><td colspan="3">HIV infection</td></tr>
<tr><td>Barrier to household growth towards extension that is characterised by household stability</td><td>Barrier to reproduction</td><td rowspan="4">Promotes the joining or residents driving the household towards an extended structure that is characterised by stability</td></tr>
<tr><td>Barrier to reproduction</td><td>Promotes separation/divorce</td></tr>
<tr><td>Promotes separation/divorce</td><td>Promotes out-migration of dependants (not of productive age)</td></tr>
<tr><td>Promotes out-migration of children</td><td>Promoted in-migration of supporters (productive age)</td></tr>
<tr><td colspan="3">Mortality</td></tr>
<tr><td>Characterised by widowhood</td><td>Characterised by widowhood</td><td rowspan="3">Promotes the joining or residents driving the household towards an extended structure that is characterised by stability</td></tr>
<tr><td>Promotes out-migration of dependants (not of productive age)</td><td>Promotes out-migration of dependants (not of productive age)</td></tr>
<tr><td></td><td>The extended household maintain the structure and thus the stability</td></tr>
<tr><td colspan="3">Household head or spouse HIV infection</td></tr>
<tr><td colspan="3">Promotes the dissolution of initially stable households - a young married couple with children or the co-residency of a child, middle-aged man and middle-aged woman</td></tr>
<tr><td colspan="3">Promotes the migration of initially stable households - married couple with children, extended, co-residency of a child, middle-aged man, middle-aged woman with or without an older adult</td></tr>
<tr><td colspan="3">Migration of single parent households in response to HIV infection of the female parent or the death of the male parent</td></tr>
<tr><td colspan="3">Incidence of migration increased in households with a married couple without children</td></tr>
<tr><td colspan="3">Household head or spouse death</td></tr>
<tr><td colspan="3">Promotes the migration of initially stable households - married couple with children, extended, co-residency of a child, middle-aged man, middle-aged woman with or without an older adult</td></tr>
</table>

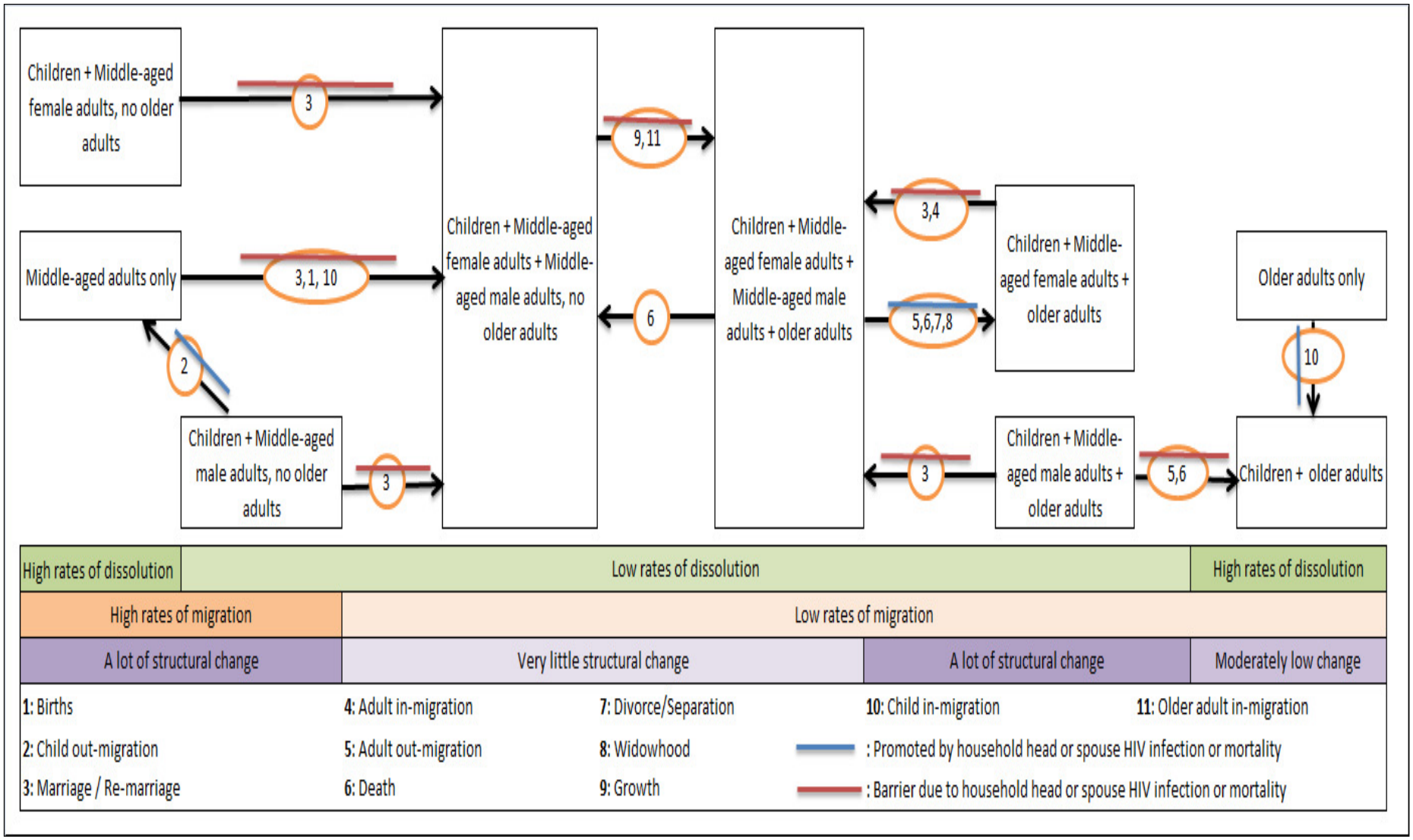

Figure 42: Household response to adult HIV infection or mortality in reference to the baseline age-sex distribution structural change

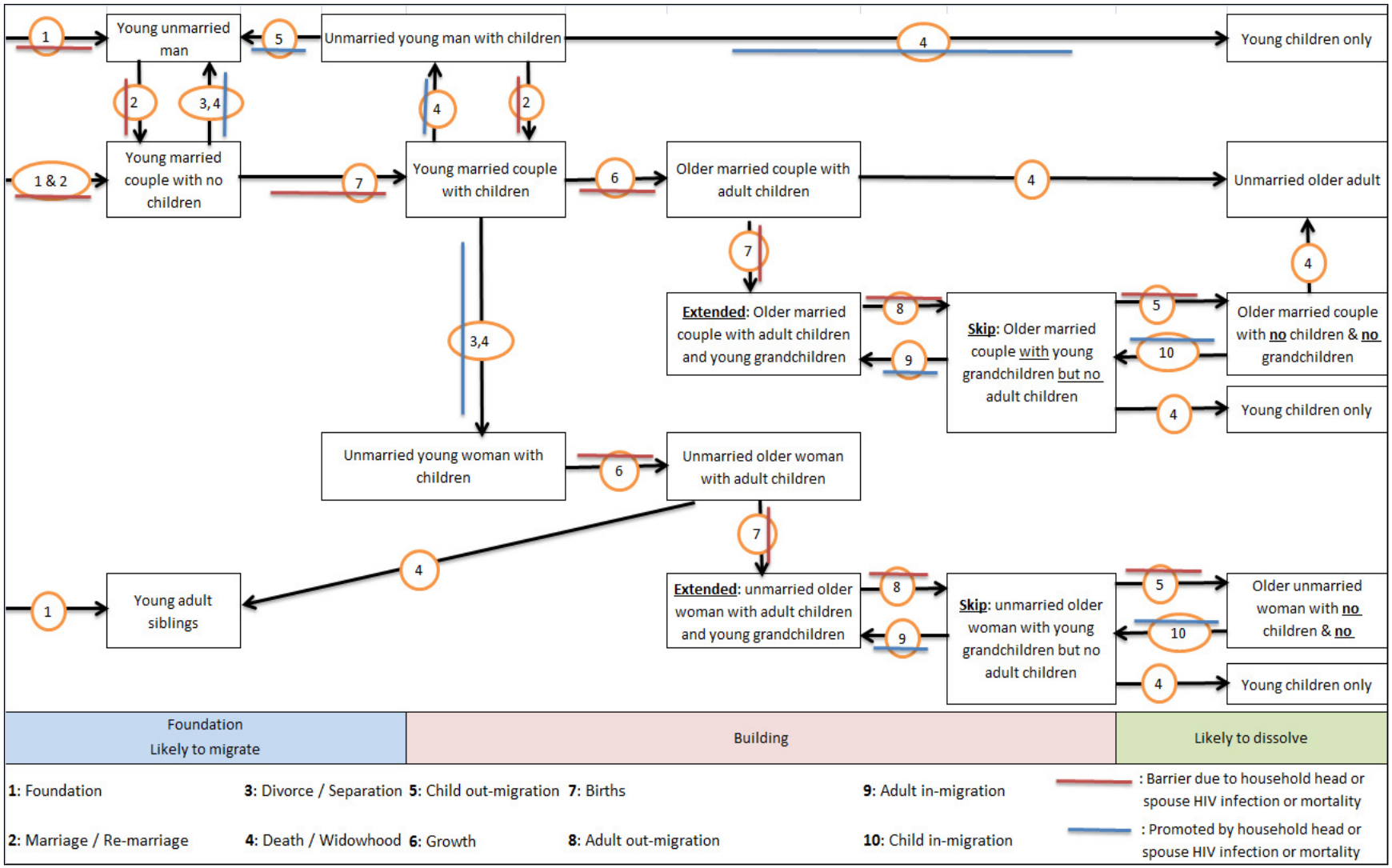

Figure 43: Household response to adult HIV infection or mortality in reference to the baseline family structural change

In addition, using the graphical representation structural changes that were presented in Chapter 3 and Chapter 4, household response to adult HIV infection or adult mortality are superimposed in the graphical representation in Figure 42 (in relation to the age-sex distributional structure) and Figure 43 (in relation to the family structure of the household). These illustrate the areas where the adult infection was a barrier and areas that were promoted as highlighted in Table 53.

5.8 Conclusion

Over 70% of persons living with HIV are in sub-Saharan Africa, 89% of whom are aged over 14 years (Zaba et al., 2004, UNAIDS, 2012). AIDS is the leading cause of death in this age group (Floyd et al., 2010). A decline in AIDS-related deaths has been observed, which is associated with increased antiretroviral treatment (Floyd et al., 2010). Despite this decline, adult HIV infection and mortality continue to affect households which respond by migrating, dissolving and changing structurally. Most investigations of the effect of adult HIV infection and mortality on households to date are cross-sectional or observe households over a short period, and most do not distinguish clearly between household dissolution and household migration. Further distinction of the effect of HIV infection by the position of the infected in the household is in most cases not taken into consideration.

The GPC study in south-western Uganda is rich in household longitudinal data and HIV information on adult residents (aged 13 and over), providing the opportunity to gain greater insight into the association between adult HIV infection and mortality, and household survival and structural change particularly relating this response to the position of the adult in the household. In addition, it is possible to distinguish household dissolution from household migration outside the study area. The only limitation is not knowing whether households stay together or dissolve once they have left the study area.

This chapter has followed the GPC households for 19 years. As was shown in Chapter 1 during the description of the study population (section 1.2.2.2), HIV infection was concentrated among adults aged 15-59 and slightly more prevalent among females. AIDS was also the leading cause of death among this age group. This agrees with the results of

other researchers, particularly those whose research is based in sub-Saharan Africa. HIV infection was more common among households with a child living with only a middle-aged man or middle-aged woman but not both or households with a single parent structure. This could be because the missing male or female adult residents are as a result of HIV infection. High HIV infection was also observed in the extended households or those with a child, middle-aged adult (man and woman) and older adult resident. This could be attributed to the ability of the large household to cater for the HIV infected financially (the large number of productive age), physically (that large number of residents) and emotionally (the co-residency of the older individuals).

Household response in the form of dissolution or migration was highest if the HIV-positive resident was the household head or the spouse with the response even higher if the head or spouse died. No evidence of a difference in the household response was observed between a death of one known to be HIV-positive and one not known to be HIV-positive. However, since HIV infection/AIDS is one of the major causes of death among the adults of productive age in sub-Saharan Africa, a household response to adult death would be of great importance as well.

Several researchers (Urassa et al., 2001, Hosegood et al., 2004a, Hosegood, 2006a, Hosegood and Timæus, 2006, Hosegood et al., 2007, Hosegood, 2008) have reported higher household dissolution and migration in households that experienced multiple adult death in relation to those with one death. In contrast, my findings show no evidence of this. However, this study like previous research has showed multiple deaths in a household in a single study period (most commonly one year) to be rare.

By position role of the deceased, household non-survival was highest if the deceased was the household head or spouse with dissolution twice as high as migration. Household non-survival was also higher if the head was female or of productive age.

Chapters 3 and 4 showed households tending to grow towards structures characterised by high survival especially extended households or those with at least a child, middle-aged adult and older adult resident. However, this chapter has showed HIV infection as a barrier to this

transition most specifically infection of the household head. This can be attributed to the middle-aged adult dying early an aspect also illustrated in the FLC presented by Hosegood et al. (2008).

In addition, HIV infection of the head or spouse was observed to promote out-migration of residents of non-productive age (children or older adults). This is a sign that the household is losing the ability to care for the dependants forcing them to seek care and support elsewhere. However, spouse HIV infection (where HIV status of the household head is either negative or unknown) was seen to lead to increased in-migration of adults of productive age. This was probably to offer support to the rest of the household and carry out the extra duties previously undertaken by the ill spouse. The same is observed if the head or spouse died, more so if the head died.

In contrast, HIV infection or mortality of other adult residents, not the head or spouse, promoted the in-migration of residents including the residents of the older generation. This drove the households towards an extended structure characterised by high survival. This could be attributed to the household headship encouraging the in-migration of residents as a coping mechanism to ensure household stability. This was also observed by Heuveline(2004), Yamano and Jayne (2004) who observed households with a death of an adult (not household head) tending to experience an increase in the in-migration of new adult residents. Also, this is in agreement with my hypothesis that a death of one not the household head results in the increase in household survival.

Divorce and separation also resulted from HIV infection of the head or the spouse. One could say this was contrary to what was observed by Bledsoe (1990) who found the divorce rate higher if the spouse was HIV-positive and the head was not. However, my analysis included those of unknown HIV status among the HIV-negative which could be the reason for the differing outcome. Porter et al. (2004) attributed the separation to: the health effect of the infection limiting the performance of the expected sex roles or the stigmatisation due to sickness or suspicion of the infection being due to infidelity. The health effect of infection can also be the cause of the barrier to reproduction between couples.

With widowhood resulting from the death of the household or the spouse, there was an emergence of single parent households or those with a child and middle-aged man or woman and not both. As mentioned above, these households showed a high presence of household head HIV infection that could have caused the death of the deceased spouse. This is in agreement with the predictions by Heuveline (2004), Hosegood (Hosegood, 2008), Mathambo and Gibbs (2008) and CHGA (2011) who predicted an increased emergence of single parent and single person households as a result of the HIV epidemic.

The resultant households after a separation, widowhood or illness due to the infection would result in those unable to cope being absorbed in other households, or those that cope migrating attributed to the stigma associated with the disease (Ankrah, 1993), or the relocation of the HIV infected to close proximity to support, health care or to a preferred place of death (Urassa et al., 2001, Yamano and Jayne, 2004).

This chapter has therefore proved that the dynamics presented in chapters 3 and 4 are altered by the household experience of adult HIV infection or adult mortality. Households continue to move towards a structure characterised by stability if the infected or deceased is not the household head or spouse.

6 CONCLUSION

6.1 Introduction

Due to the dynamic nature of households, the social and demographic patterns within households as well as the patterns of disease has become an aspect of major interest especially in the area of HIV research. The aspect of household dynamics has been covered by many researchers, however, as I have shown in this thesis, most of these investigations have been cross-sectional studies looking at household size and composition, with very little work on changes over time (Chirwa et al., 2004). However, to adequately observe any household changes, a household needs to be followed for at least two years (Bachmann and Booysen, 2003).

This thesis therefore aimed at longitudinally observing the household dynamics in a rural sub-Saharan setting ascertaining how the household dynamics are influenced by the household's characteristics (that is characteristics of the household residents, family relationships in the household and the household's socio-economic status levels) and experience of household member HIV infection and mortality. This was made possible by the availability of the secondary data from the General Population Cohort (GPC), a community based study that annually collects information from household residents in rural south-western Uganda. The information is, however, collected in a cross-sectional nature which needed to be transformed to longitudinal nature. The purpose of this thesis was therefore to:

- Develop criteria to retrospectively trace households over time
- Create household structural typologies that classify household by their age-sex distributions and family relationships of the household members and observing the cross-sectional distribution of the GPC households in respect to their structure
- Observe the household dynamics in relation to household survival (with non-survival representing household dissolution or household migration outside the study setting), and the change in the household's structure over time

- Observe whether these overall dynamics are altered by an experience of HIV infection or mortality in the household

Guided by studies that had been designed to prospectively follow households over time in rural South Africa (Hosegood et al., 2004a) and northern Malawi (Wittenberg and Collinson, 2007), the developed criteria enabled the retrospective tracing of GPC households over 19 annual survey periods between 1989 and 2008.

This was followed by a structural classification of the households by their age-sex distribution identifying a middle-aged adult as one aged between 15 and 59 years (guided by the work by the ALPHA-network); and family structure identifying family relationships between the household head and the other household residents (guided by work done by Hammel and Laslett (1974), Wittenberg and Collinson (2007), and Hosegood (2008)).

In relation to the household's structure, both cross-sectional and longitudinal analyses were undertaken to determine the distribution, survival and structural change of households over time. The cross-sectional analyses showed snap-shots of households for each of the 19 surveys (between 1989 and 2008) covered in the thesis. Alternatively, the longitudinal analysis was undertaken using short-term (annual) and long-term (four to five years) FPs (SFP and LFP respectively). This provided longitudinal survival of households and their changes in structure over time in reference to the structure at baseline.

Confirming that HIV infection was concentrated among the adults of productive age (15-59 years, particularly on average, 82.3% of the HIV-positive participants aged between 15 and 49 years), the patterns of household survival and structural change were observed to see whether these patterns were altered by an experience of adult resident HIV infection or mortality. The adults focused on in this case were the household heads, their spouse(s) and other residents aged 15 to 59 years. Adult resident HIV infection or death was stratified by the position role of the resident (head, spouse or other adult) to identify whether the households responded differently to who was infected or died.

6.2 Tracing households

This exercise was undertaken to restructure the annual cross-sectional household GPC information to a longitudinal nature. This was done to enable me observe the household dynamics over periods longer than one year. The GPC like many other demographic health studies gathers and retains household information at the point in time when 'the household' joins the cohort and is assigned an identification number based solely on the physical location of the household. This number continues to be used as long as the house structure remains occupied. This is appropriate for cross-sectional analysis, however, it makes it difficult to carry out longitudinal analysis as households cannot be easily traced over time. This thesis undertook the task of developing criteria that can retrospectively trace households over time utilising secondary data on households collected at different time points.

The development of these criteria was guided by studies in sub-Saharan Africa that were designed to prospectively trace households which were: the Wittenberg and Collinson (2007) investigation of changes in household structure in rural South Africa over the period 1996–2003; the Hosegood et al. (2004a) investigation of the impact of adult mortality on household dissolution and migration in rural South Africa between 2000 and 2002; and the Chirwa et al. (2004) study of household dynamics in northern Malawi during the 1980s. These investigators mainly determined the existence of the household between two time points by either the status of the household head; or alternatively the residency of the majority of the household residency. I chose to use the status of the household head between time points to determine the status of existence of the household head. This procedure was made possible by the availability of the unique identification of the individuals participating in the study, family relationships between household residents and their residents' movement status (that is movement in or out of the household, deaths or births).

A household was therefore said to relocate when the household head relocated to another location within the study area and retained headship, to migrate if the household head relocated outside the study area, and to dissolve if the household head lost headship. However, if the household head died, the household remained the same if a close relative of

the deceased took over headship or if the majority of the deceased children remained resident in the household. Migrated households were considered as the same if the household head was identified again as head in the study at later time points.

In cases of a divorce, the household headed by the one who was the head before the divorce was considered as the same household while that headed by the other divorced spouse was considered as a new household. Newly created households were those headed by individuals that had not been identified as heads in prior time periods or were heads of a previously dissolved household. Special care was also made to identify households that reported changes in household headship characterised by the headship being switched between the household residents usually between a man and his spouse. These households were identified as the same household as long as these residents remain co-resident.

Applying these criteria to the GPC households enabled the tracing of households for the 19 survey periods between 1989 and 2008. Dividing the FPs into 4 blocks of 4 to 5 years (LFPs), on average: 69.1% of the households at the start of the FP (baseline) were identified as the same throughout the LFP, 3.9% migrated or were lost to follow-up but were identified again before the end of the LFP, 15% migrated and did not return during the LFP, 3.8% were lost to follow-up and did not return during the LFP, and 8.1% dissolved.

Table 54: Summary of the percentage of household survival over the four LFPs

Follow-up period (LFP)	Percentage that:		
	Survived	Dissolved	Migrated
1989/1990 - 1993/1994 (N=1,894)	74.4%	8.3%	13.9%
1993/1994 - 1998/1999 (N=2,019)	70.6%	8.7%	**17.5%**
1998/1999 -2003/2004 (N=2,152)	71.6%	9.9%	14.2%
2003/2004 - 2007/2008 (N=3,489)	75.4%	**5.7%**	14.5%

A further investigation of the rates of household dissolution and migration showed the overall migration rates were almost twice as high as the dissolution rates. The highest migration rates were observed in 1992-1995 and 2003-2005. This could be attributed to droughts in 1992 and prolonged dry spells in 2004, reported in Seeley (2013), resulting in

low yields and food shortages. This is also observed by looking at the percentage of households that migrated between the four LFPs (Table 54), the highest percentage of migration was between 1993/1994 and 1998/1999.

No evidence of difference in the dissolution rates in the old and new villages was observed, however, the migration rates were significantly higher in the new villages (rate ratios 1.36[p<0.001] and 1.31 [p<0.001] in the short- and long-term analyses respectively). High migration rates in the new villages could be attributed to the new villages being located close to a major trading centre (Shafer et al., 2008). Such areas are commonly characterised by frequent movement as individuals in search for better trading and employment opportunities (Barratt et al., 2012).

A look at the percentage of household dissolution across the four LFPs (Table 54) showed the least dissolution between 2003/2004 and 2007/2008. This corresponds with the period when free ART was offered to the HIV-positive GPC participants that was rolled out in 2004. In fact a comparison of the dissolution rates before and after 2004 showed strong evidence that the rates of dissolution lower after 2004 (SFP rate ratio=0.65, LFP rate ratio=0.74; p<0.001). The reduction of dissolution could therefore be attributed to the availability of ART that reduced mortality and morbidity of the HIV–infected residents.

I compared these findings with those attained in the study by Hosegood et al. (2004a) study in rural South Africa between 2000 and 2002 that had a similar definition of a household to that used in the GPC. Between January 2000 and October 2002 the study in South Africa showed 8% of the households migrating, while, 8.7% of the GPC households migrated during a two year follow-up between survey periods 1999/2000 and 2001/2002, showing similar results between the two studies. The minor differences could be attributed to the differences in the length of follow-up and the differences in the rural South African and rural Ugandan settings.

The study settings for the study of household dynamics in northern Malawi, during the 1980s (Chirwa et al., 2004) and the GPC are broadly similar. However, the identification of the same household between two time points differ slightly with the study in Malawi identifying a household as the same if most of the members remained together irrespective of whether

there was a change in the household head. A five-year household follow-up in the Malawi study showed more than 84% of the households at the start of the follow-up period considered as the same at the end of the follow-up period including the 8% that changed headship. The GPC, on the other hand, reported a survival of 73%. The difference in the percentages could be attributed to the differences in the definitions of household 'continuation'.

The similarity in the results from the GPC and those from the studies designed to trace households prospectively in rural South Africa and northern Malawi shows that the criteria developed in this thesis compares very well to the prospective criteria. However, for the retrospective criteria to be applied residents need to be uniquely identified and the relational information between the residents as well as the movement status recorded at all the survey time points.

6.2.1 Limitation of tracing procedure

The tracing procedure, however, had a limitation of not being able to determine whether the household remained together outside the study area or dissolved. This limitation is experienced in most (if not all) that carry out demographic surveillance studies.

In addition, care is needed when comparing these results to fairly similar studies in sub-Saharan Africa mainly due to the differences in the household tracing criteria and the length of follow-up.

6.3 Classification of households

To enable the exploration of patterns of household behaviour over time, the households needed to be structurally classified in categories that represent their characteristics. My choice of the characteristics was based on those that could be used to identify household response to HIV infection. These were the household's composition represented by the age-sex distribution of the residents and the family structure representing the family relationships between the residents. This household classification was designed assuming that there is a fundamental similarity between households with the same structural

characteristics being affected similarly by events occurring in the household or threats to the household.

6.3.1 Age-sex distribution

The development of this typology was drawn from the work done by the ALPHA-Network classifying households by the age and sex of the household residents. Each resident was first classified as either a child if aged under 15 years; middle-aged adult if aged 15-59 years; and older adult if aged over 59 years. The typology was then created to represent the existence of either of the age categories in the household, with the households that had a child and middle-aged adult living together having the middle-aged adults classified further by sex.

6.3.1.1 Cross-sectional findings

The application of the typology to the GPC households showed a fairly similar distribution of the household structure over the 19 surveys. On average, over 46% of the households with a child, middle-aged man and middle-aged woman living together while 16.7% of the households had only middle-aged adults. Over 63% of the middle-aged only households had only male resident(s) while 23.5% had a man and a woman. The households with only middle-aged adults were observed to increase over time; while those with a child, middle-aged man and middle-aged woman decreased over time. Only 7% of the households had no middle-aged adult living in the households with 58.9% of these with only older adult residents (also increasing over time); 40.4% with children and older adults living together; and only 0.8% with only children residents. The households with at least one older adult were commonly (91.5%) headed by an older adult while those headed by a middle-aged adult were commonly headed by a married middle-aged man or an unmarried middle-aged woman.

By household headship, there was an even distribution between the married and non-married heads. Households were mainly headed by a middle-aged adult man which could explain why only less than 10% of female-headed households were married. The child headed households were few and this could be attributed to the role played by the extended

family system that promotes the fostering and caring of children. Over time, reduction of the male heads or the men heads that were married was observed. This could be showing a reduction in young men starting or sustaining their households, as well as a delay in marriage or remarriage among men.

6.3.1.2 Longitudinal findings

In the longitudinal analysis, the investigations over the SFPs and the LFPs showed similar patterns and outcomes. Household dissolution and migration (non-survival) was least among households with a co-residency of an older adult. The stability could be the result of the growth of the household over time (especially if the head is an older adult) or the presence of the older adult as dependant showing that the household is capable of catering for the extended family

Dissolution was mainly attributed to the young adults returning to their home of origin due to failure to cope on their own (Seeley, 2013), young adult women joining households in marriage, children relocating from one household to another for better care (Heuveline, 2004, Monasch and Boerma, 2004) or a death especially among the elderly (Hosegood, 2008). High tendencies of dissolution were thus observed in households with only a middle-aged adult; with no middle-aged adult; or those with no co-residency of a middle-aged man and middle-aged woman.

Migration was attributed to the frequent movement of individuals which was common among the middle-aged adults mainly in search of better employment opportunities (Barratt et al., 2012). This was therefore common in households with no older adult resident.

The structural change showed households transitioning to the stable structures through the in-migration of children (through births or fostering) and in-migration of productive adults (through marriage, or for support after being unable to sustain own household, or to provide extra labour support)

Finally, the scarcity of longitudinal household studies that look at the household structure to this detail made the comparison of these findings difficult. And the few that undertook the

task looked at the survival of households by the household head characteristics such as the study in northern rural Malawi by Chirwa et al. (2004). The findings of this thesis were in agreement with the findings by Chirwa et al. (2004), however, the thesis went beyond household head characteristics by looking at the age-sex distribution of these households. I can therefore argue that this aspect of the PhD provided an approach that provides a broader view in the household dynamics in the area of the household's composition.

6.3.2 Family structure

This classification mainly represents the kinship or family relationships in the household in reference to the household head. The structural classification was guided by the descriptions of a family unit by Hammel and Laslett (1974) and household classifications various researchers such as Wittenberg and Collinson (2007) and Seeley (1993) who refers to the same study setting used in the thesis. The aspects included in the classification were: single person household, married couples with or without children, single parent households living with their children, households with more than two family generations, skip generational households and the unmarried siblings living together. These aspects were chosen mainly due to the increasing interest of these household aspects in AIDS research. Unlike the age-sex distribution, residents with no family relationship, for example, resident labourers were not identified in the classification.

6.3.2.1 Cross-sectional findings

An application of this classification to the GPC households showed:

- 42.7% having married couples with 90% of these households living with their biological children;
- 11.3% as single parent households;
- 18.7% as single person households;
- 17% having more than two family generations co-resident;
- 10% having a skip generational family structure; and
- 1.6% with unmarried siblings living together.

The comparison of the cross-sectional distribution from one survey period to next showed an increase in:

- single person households that could be attributed an increased generation of new households by the younger adults, increase in widowhood , increase in couple separation and less marriage or remarriage
- Single female parent households that could be attributed to an increase in widowhood or separation with less remarriage
- Extended and skip generational households that could be attributed to an increase in the in-migration of grandchildren and the less co-residency of the adult children

There was, however, a decrease in the households with married couples without children. The reduction in the households with this structure was mainly due to structural changes commonly resulting from in-migration of children (through couple reproduction or fostering) or adult out-migration (as a result of couple separation/divorce or death).

6.3.2.2 Longitudinal findings

With the SFP and LFP investigation showing similar patterns, household dissolution was mainly due to the death of the elderly in single person households; and absorption of single female parent households in remarriage or to another existing household. Migration, however, was mainly attributed to the productive residents seeking employment. This was in single middle-aged adult households, young married couples without children, and single male-headed households. High survival was observed among the married couples with children and the extended households.

Similarly, the age-sex distribution, the observation of the household patterns over time showed the households mainly transitioning to the stable structures through the single getting married, married couples having children, and the growth of households to an extended structure.

6.4 Comparing family structure and age-sex distribution classifications

Presented above as in Chapters 3 and 4 were the two chosen typologies to structurally categorise the households. However one may wonder if there are any differences between the structures or if one could be used in place of the other. Table 55 presents a complete percentage comparison of the households by their family structure and age-sex distribution.

Note that classification by family structure does not identify household residents with no kinship to the family such as servants while the age-sex distribution typology includes them in the classification. Further, the inclusion of those aged less than 15 years (children) in the family structure was dependent on whether the child had a kinship relationship with the household head or his spouse. This thus excludes fostered children with no kinship relationship to the head, spouse or children of residents of no kinship relationship to the head or spouse.

To enable a clear comparison the structures are split into groups of one-generational households, households with a married couple (with or without children), single-parent households, and extended households within which the percentage distribution of the age-sex distribution is determined.

Table 55: Percentage comparison of the family structure and age-sex distribution structures

Family structure	Age-sex distribution										
	Children only	Middle-aged adults only	Older adults only	Children + Middle-aged female adults, no older adults	Children + Middle-aged female adults + Middle-aged male adults, no older adults	Children + Middle-aged male adults, no older adults	Children + Older adults only	Children + Middle-aged female adults + older adults	Children + Middle-aged female adults + Middle-aged male adults + older adults	Children + Middle-aged male adults + older adults	Middle-aged adults + Older adults, No children
Single person household: Male	0.2	81.8	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Single person household: Female	0.3	57.3	42.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Head + spouse(s), no biological children	0.0	62.9	7.1	0.4	14.7	1.3	0.5	1.5	0.7	0.2	10.6
Nuclear: Head + Spouse(s) + Biological Children	0.0	0.6	0.0	0.1	91.4	0.2	0.0	3.0	3.9	0.0	0.7
Single parent: Male Head + Biological Children	0.0	10.7	0.1	0.0	16.2	48.0	6.2	0.7	2.7	3.9	11.4
Single parent: Female Head + Biological Children	0.0	5.0	0.5	60.9	26.6	0.0	0.2	1.2	2.1	0.1	3.5
>2-generational household: Upward extended	0.0	0.4	0.0	4.1	25.7	0.0	0.0	7.1	54.1	5.3	3.3
>2-generational household: Downward +/- Upward extended	0.0	0.1	0.0	8.9	38.2	0.3	0.5	14.8	30.7	5.2	1.2
Head + Parent, No biological children	0.0	11.8	5.9	0.8	21.0	0.0	0.8	10.1	6.7	10.9	31.9
Skip generational household: Downward +/- Upward extended	0.0	0.9	0.1	13.9	7.8	0.5	23.1	18.2	14.4	12.0	9.0
Sibling only	0.5	43.6	7.0	7.8	19.9	12.8	0.2	2.0	2.3	0.2	3.6
Head +/- others[1]	0.2	33.8	1.7	19.1	12.6	7.5	6.8	4.1	2.8	1.8	9.7

[1] household members with (and/or without) a kinship relationship not classified above

Highlighted: percentages > 10%

6.4.1 1-generational households

Looking first at the one-generational family structures (Table 56), the single-person households show the men as middle-aged and the women either middle-aged or older. The 'sibling-only' and 'head + other' structures not only represents a co-residency of only middle-aged adults, but also a co-residency of children and middle-aged adults.

Table 56: Percentage distribution of the age-sex structure for households of a 1-generational family structure

1 -generational households		Percentage	Total percentage
Single person households			
Male	Middle-aged adults only	81.8%	81.8%
Female	Middle-aged adults only	54.3%	
	Older adults only	42.5%	96.8%
Sibling only			
Middle-aged adults only		43.6%	
Children + middle-aged female adults + middle-aged male adults, no older adults		19.9%	
Children + middle-aged male adults, no older adults		12.8%	76.3%
Head + other (of no close or no relation to the head)			
Middle-aged adults only		33.8%	
Children + middle-aged female adults, no older adults		19.1%	
Children + middle-aged female adults + middle-aged male adults, no older adults		12.6%	65.5%

6.4.2 Households with a married couple

Households with a married household head and co-resident spouse(s) could be assumed to have a 'middle-aged adult only' or 'older adult only' structure, plus children or middle-aged adults, respectively, if the couple has biological children. The comparison shown in Table 57 approximately agrees with this assumption. However, 14.7% of the 'head + spouse(s), no biological children' households that have an age-sex distribution of children plus middle-aged adults could be wrongly assumed to have a nuclear structure, although the children in this case are not the biological children of the household head or his/her spouse.

Table 57: Percentage distribution of the age-sex distribution of married couple households with or without children co-resident

Head + spouse(s), no biological children	Percentage	Total percentage
Middle-aged adults only	62.9%	
Children + middle-aged female adults + middle-aged male adults, no older adults	14.7%	
Middle-aged adults + older adults, no children	10.6%	88.2%
Nuclear: head + spouse(s) + biological children		
Children + middle-aged female adults + middle-aged male adults, no older adults	91.4%	91.4%

6.4.3 Single parent households

Single parent households with biological children could be assumed to have an age-sex distribution of children plus at least one middle-aged adult, middle-aged adults plus older adults, or only middle-aged adults. Table 58 shows agreement with this assumption. However, some of these households could be incorrectly assumed to represent a nuclear household if they include both a middle-aged man and a woman.

Table 58: Percentage distribution of the age-sex distribution for households of a single parent family structure

Single parent head co-resident with biological children		Percentage	Total percentage
Male head	Children + middle-aged male adults, no older adults	48.0%	
	Children + middle-aged female adults + middle-aged male adults, no older adults	16.2%	
	Middle-aged adults + Older adults, No children	11.4%	
	Middle-aged adults only	10.7%	86.3%
Female head	Children + middle-aged female adults, no older adults	60.9%	
	Children + middle-aged female adults + middle-aged male adults, no older adults	26.2%	87.1%

6.4.4 Extended households

Lastly, extended family households could be assumed to have all three age groups. However, as shown in Table 59, some of these households do not include any older adults. The skip-generational structure could be assumed to include child(ren) plus older adult(s). This is true of only 23.1% of these households, with a larger percentage having at least one middle-

aged adult resident. Then there is the 'head + parent', the least represented structure in the GPC (0.2%) and least discussed by researchers. This structure could be assumed to have a middle-aged plus older adult structure which indeed represents 31.9% of households and some of these households including a child or only middle-aged adults.

Table 59: Percentage distribution of the age-sex distribution in households of an the extended family structure

Extended households	Percentage	Total percentage
>2-generational household: downward +/- upward extended		
Children + middle-aged female adults + middle-aged male adults, no older adults	38.2%	
Children + middle-aged female adults + middle-aged male adults + older adults	30.7%	
Children + middle-aged female adults + older adults	14.8%	83.7%
>2-generational household: upward extended		
Children + middle-aged female adults + middle-aged male adults + older adults	54.1%	
Children + middle-aged female adults + middle-aged male adults, no older adults	25.7%	79.8%
Skip generational household: downward +/- upward extended		
Children + older adults only	23.1%	
Children + middle-aged female adults + older adults	18.2%	
Children + middle-aged female adults + middle-aged male adults + older adults	14.4%	
Children + middle-aged female adults, no older adults	13.9%	
Children + middle-aged male adults + older adults	12.0%	81.6%
Head + parent, no biological children		
Middle-aged adults + older adults, No children	31.9%	
Children + middle-aged female adults + middle-aged male adults, no older adults	21.0%	
Middle-aged adults only	11.8%	
Children + middle-aged male adults + older adults	10.9%	
Children + middle-aged female adults + older adults	10.1%	85.7%

6.4.5 Recommendation

With these differences in the age-sex distribution and the family structure typologies shown above, one typology cannot be used to distinctly represent the other. The choice of classification to be used depends on the interests of the researcher, that is, whether the interest is in the relational composition or the age-sex distributional composition of the households. However, the choice of a structure of interest in an investigation, for-instance

the single parent family structure could be expanding to include the age-sex distributions within the household to investigate whether the households of different age-sex distributions behave differently.

6.5 Effect of HIV infection and mortality

Recent publications by UNAIDS (2012) have shown that sub-Saharan Africa remains the epicentre of the HIV epidemic with over 70% of the persons living with HIV globally in sub-Saharan Africa of whom 89% are aged more than 14 years. The GPC study setting showed HIV concentrated among individuals aged 15-59 years and slightly more prevalent among the females. Deaths of the HIV infected were also highest within this age group, which means that an investigation based on the deaths of the productive residents could be used to approximate the ultimate effect of HIV related deaths. By the structure of the households, HIV infection was highest among the single parent households or those with a child living with either a middle-aged man or middle-aged woman. This could have been attributed to the fact that the household structure is actually a result of widowhood of separation attributed to HIV infection. HIV infection was also high among the extended households or those with a child and middle-aged adult living with an older adult. This could be attributed to the capability of the large family to care and support the infected resident.

As pointed out by Bachmann and Booysen (2003), Timæus (2006a) and Hosegood et al. (2007) the impact of the HIV infection on the person's family or household gradually unfolds over time. Therefore, to observe this impact, households need to be observed for longer periods of time, thus the need for household longitudinal investigations. With the households traced over time, undertaken was a longitudinal investigation of the household response to productive adult HIV infection and mortality by considering the position of the infected or deceased and the baseline structure of the households.

6.5.1 Longitudinal findings

The overall longitudinal analysis using the LFPs showed household response in relation to household non-survival was highest if the infected or deceased was the household head or spouse. The HIV infection increased tendencies of household migration while deaths increased tendencies in household dissolution. Household migration rates in response to HIV infection (in comparison to those with the same structure but no HIV infection) was more among the households that were initially stable that is the married couples with children, extended households; or households with a child, middle-aged man and middle-aged woman living with or without an older adult. It shows more couples choosing to stay together during the infection. Migration was a coping mechanism in relation to closeness to care, support and less stigma to the disease.

However, household dissolution response to household head death was highest if the deceased was female or a middle-aged adult particularly in single female parent households, skip generational households and households with a child, middle-aged female with or without an older adult. With the death of the head, the remaining dependants (children and older adults) had to be absorbed into other existing households.

Alternatively, the infection or death of other adult residents increased the survival of the households. This was seen to correspond to an in-migration of productive and non-productive residents creating a stable extended structure. This was also gradually seen in the households that experienced no adult HIV infection or mortality with the households transitioning to structures characterised by stability. However, household head HIV infection was seen to disrupt this transition as the infection limited the growth progression of the household. The infection also promoted the out-migration of dependants (that could be attributed to their inability to care for them); promoted divorce/couple separation; and a barrier of reproduction among the married couples.

Widowhood was seen as resulting from the deaths, explaining the emergence and increased prevalence of HIV infection among the single-parent households or those with a middle-aged man or middle-aged woman, but not both.

6.5.2 Other findings from the longitudinal analysis

Despite adult death having a strong impact on both household dissolution and household migration, no significant difference in the impact was observed among households that experienced one adult death and those where multiple adult deaths were experienced. This was not in agreement with some studies in sub-Saharan Africa that showed a higher risk of household dissolution and migration in the households that experienced multiple adult deaths in comparison to those that had one adult death (Urassa et al., 2001, Hosegood et al., 2004a, Hosegood, 2006a, Hosegood and Timæus, 2006, Hosegood et al., 2007, Hosegood, 2008). However, an experience of multiple adult deaths among the GPC households as well as in these other studies in sub-Saharan Africa was rare. In agreement with other studies in sub-Saharan Africa (for example those by: Urassa et al. (2001), Mushati et al. (2003) and Hosegood et al. (Hosegood et al., 2004a, Hosegood and Timæus, 2006)), the analysis in this thesis found no significant difference in the impact of HIV related adult mortality and non-HIV related adult mortality on both household dissolution and household migration.

6.5.3 Limitations in the investigation

This study was unable to distinguish between AIDS deaths and deaths from other causes (known or unknown). However a death of one known to be HIV-positive was assumed to be HIV related. There were also cases where persons were incorrectly reported as household members to attain the free HIV care provided by the GPC programme. This could have increased the numbers of households with an HIV-positive adult in the GPC study area. However, since these persons were not household head or spouse of the head, this did not have much impact on the findings in this thesis which mainly focused on the effect of HIV infection or mortality of the household head or his/her spouse. Other adult resident HIV infection or mortality did not have much impact on the survival or structural change patterns of the households.

The study could not look beyond the households affected by adult HIV infection or adult mortality to look at the burden suffered by the unaffected households that had family or friendship ties to the affected households. The burden could include providing support (for

example financial, labour or material support) or by taking in household members (for example fostering children); and whether this is leading to the emergence of the skip generational households or households missing middle-aged adults, as predicted by several researchers. Although the study showed some increase in the skip generational households in the early years of the study, this was seen to stabilise in the later years.

However, an unaffected household could be receiving support from an affected household, for example, a death of an uncle who was paying school fees for a nephew in an unaffected household. Further investigation is therefore needed to capture more information on the arrangements and relationships with persons outside households, for example, non-resident family members, sources of financial support, and if a child is fostered whether at least one parent is alive and the reason for fostering. Investigations are also needed to identify the changes in the structure in households indirectly affected by AIDS. This can be done by selecting a smaller sample of households of interest from which this additional information could be attained to carry out a more detailed investigation.

In this thesis, the reasons for household behaviour have been based on the household changes observed and what was predicted or observed by other researchers (as presented in literature). More detailed research should therefore be done by considering a sample of the households with a structure(s) and experience of interest. This will help identify the actual reasons for the household response in relation to adult HIV infection and mortality. This investigation will also help distinguish between the positive and negative responses guiding the policy makers where to emphasise the needed programmes. This thesis will therefore act as a benchmark for this further research that will provide an even clearer picture of household dynamics in sub-Saharan Africa.

6.6 Summary

Despite being of great interest in research on the demographic impact of the HIV epidemic on households, large-scale longitudinal studies are rare. This has mainly been attributed to the high costs of carrying out such studies. What have instead been undertaken are either cross-sectional studies at different time points, or relatively small cohort studies. This study

has provided a means to retrospectively link 19 cross-sectional surveys conducted in rural south-western Uganda to enable longitudinal investigations of how households evolve over time, against a background of moderately high adult HIV prevalence. The study also identified ways in which a household could be classified according to the characteristics of the residents by identifying the age-sex distribution and the family structure of the households. Bringing these two things together enabled analyses of household dynamics looking specifically at the dissolution, migration, and structural changes of the household. Further attained was a an understanding of which household types were more or less vulnerable to dissolution and more or less fluid in their household membership. Building on this, the impact of adult HIV infection and adult mortality on household survival and structural change was investigated. Important conclusions were that the impact of adult HIV infection on household dissolution and household migration was largest when the HIV-infected individual was the household head or his/her spouse, and that most of the impact of adult HIV infection was explained by household head or spouse mortality. The impact of a death of the household head or his/her spouse varied by the household's age-sex distribution and family structure, but the impact was substantial across all household types. Effects on household dissolution were much greater than on whole household migration, and those most vulnerable to dissolution were households consisting of a child and an older adult with no middle-aged adult, a child, middle-aged man and older adults, or single parent family structures.

In conclusion I observed household migration mainly attributed to drought, famine, food shortage, HIV infection of the major household decision makers/providers and employment opportunities. However, dissolution was attributed to the death of the major household decision maker/provider, marriage in households headed by a woman or a young adult returning home. Alternatively, the use of ART was seen to reduce dissolution tendencies. This could be attributed to the reduction in deaths particularly among the middle-aged adults.

I also observed delayed marriage and remarriage among the young men (heads) corresponding to a reduction in young married couple households, while there was an

increase in single person, extended and skip-generational households. Least tendencies of household dissolution and migration (household stability) were mostly in extended households with the households being seen to achieve mainly through in-migration of children (through births or fostering) or young adults (through marriage, seeking/providing support, or in provision of labour). Young adult in-migration was a common practice in households that experienced HIV infection or deaths of residents who were not major decision makers/providers as a coping mechanism to maintain the stability of the household.

The emergence of single parent households seemed to be associated with HIV infection (through separation/divorce) or HIV-related deaths (resulting in widowhood). However, the extended households seemed strong enough to maintain stability even with HIV infection or deaths of the decision makers, except for skip generational households where the dependants needed to be absorbed into other households.

I thus conclude that a household's stability is mainly dependent on the movement of its residents towards or away for a structure of stability. Therefore I can recommend at this stage that sustained stability could be encouraged by reducing deaths of decision makers (say through early testing and treatment of HIV), encourage community participation in affected households say through the in-migration of young adults that help sustain the stability of the household.

With the GPC households traced since 1989, researchers, using the valuable information collected since 1989, will now be able to carry out longitudinal household investigations. This research has also highlighted the specific areas needing specific longitudinal investigation that will guide policy makers in designing the appropriate developmental programmes. These further investigations would for example work together with the work done by, say, Janet Seeley (Seeley, 1993) in her search for the household coping mechanisms in south-western Uganda. However, this time a more detailed aspect of the household's structure will play a major role in the observation of the reasons for the household's dynamics.

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8 APPENDIX

8.1 Household counts by Survey period and location

Earlier calendar periods	Number of households	Later calendar periods	Number of households		
			Total	Old villages	Additional villages
1989/90	1,894	1999/2000	3,433	2,193	1,240
1990/91	1,966	2000/01	3,548	2,282	1,266
1991/92	2,045	2001/02	3,492	2,221	1,271
1992/93	2,001	2002/03	3,503	2,222	1,281
1993/94	2,019	2003/04	3,489	2,221	1,268
1994/95	1,971	2004/05	3,454	2,185	1,269
1995/96	1,988	2005/06	3,422	2,144	1,278
1996/97	2,011	2006/07	3,478	2,176	1,302
1997/98	2,111	2007/08	3,629	2,280	1,349
1998/99	2,152				

8.2 Example of some of the restructuring done in the coding

Examples of some of the restructuring done in the coding are represented below showing the relationship to the household head in bold and examples of the different relationships that have been grouped under this new relationship to the household head

Biological Children

- Children of the household head
- Children of the spouse of the household head

Other children

- Spouse of the child of the household head
- Brother or sister of the child of the household head
- Spouse of the child of the spouse of the household head
- Brother or sister of the child of the spouse of the household head
- Grand child of the parent of the household head
- Grand child of the parent of the spouse of the household head
- Parent of the grandchild of the household head
- Parent of the grandchild of the spouse of the household head
- Child of a brother or sister of the household head
- Child of a brother or sister of the spouse of the household head
- Other relatives not specified aged <=15 years of age
- Children aged <=15 years of age of no family relationship to the household head

Parent

- Parent of the household head
- Parent of the spouse of the household head
- Spouse of the parent of the household head

- Spouse of the parent of the spouse of the household head

Aunt/Uncle

- Brother or sister of the parent of the household head
- Brother or sister of the parent of the spouse of the household head
- Parent of a brother or sister of the household head
- Parent of a brother or sister of the spouse of the household head

Sibling

- Brother or sister of the household head
- Brother or sister of the spouse of the household head
- Child of the parent of the household head
- Child of the parent of the spouse of the household head

Cousin / Sister–in-law/Brother–in-law

- Spouse of a brother or sister of the household head
- Spouse of a brother or sister of the spouse of the household head
- Brother or sister of a brother or sister of the household head
- Brother or sister of a brother or sister of the spouse of the household head

Grand child

- Grand child to the household head
- Grand child to the spouse of the household head
- Child of a child of the household head
- Child of a child of the spouse of the household head
- Grand child of a brother or sister of the household head
- Grand child of a brother or sister of the spouse of the household head
- Spouse of the grandchild of the household head

- Spouse of the grandchild of the spouse of the household head
- Brother or sister of the grand child of the household head
- Brother or sister of the grand child of the spouse of the household head

Great grandchild, great -great ... grandchild

- Grand child of the child of the household head
- Grand child of the child of the spouse of the household head
- Child of the grand child of the household head
- Child of the grand child of the spouse of the household head
- Grand child of the grand child of the household head
- Grand child of the grand child of the spouse of the household head

Grand parent

- Parent of the parent of the household head
- Parent of the parent of the spouse of the household head

Other household members

- Other relative (not specified) to the household head or spouse aged >14 years
- Household members of with no family relationship to the head or spouse >14 years

8.3 The distribution of the GPC households by household size

Appendix table 1: Percentage of the GPC households by household size and survey period

Survey period	Number of household members (Household size)					Number of households
	1	2 - 3	4 - 5	6 - 7	>7	
1989/90	13.4	21.2	21.4	18.0	26.1	1,894
1990/91	14.2	22.6	22.8	18.2	22.2	1,966
1991/92	13.6	23.2	24.3	16.9	22.1	2,045
1992/93	13.3	23.5	23.8	17.3	22.0	2,001
1993/94	13.5	23.0	24.7	18.5	20.3	2,019
1994/95	13.1	22.3	23.8	20.3	20.5	1,971
1995/96	13.0	23.8	24.1	18.8	20.2	1,988
1996/97	12.9	23.0	23.1	19.9	21.1	2,011
1997/98	14.3	23.9	22.2	19.0	20.6	2,111
1998/99	14.1	22.7	23.6	18.8	20.8	2,152
1999/2000	15.5	22.7	22.7	17.5	21.6	3,433
2000/01	16.1	22.0	22.4	17.9	21.6	3,548
2001/02	16.1	21.1	22.7	18.2	21.8	3,492
2002/03	17.1	20.5	21.8	18.8	21.8	3,503
2003/04	17.8	19.7	22.0	18.2	22.3	3,489
2004/05	17.8	19.6	21.0	18.1	23.5	3,454
2005/06	16.6	19.3	21.4	18.3	24.4	3,422
2006/07	16.6	19.8	21.1	19.9	22.6	3,478
2007/08	17.1	20.3	20.6	20.0	22.0	3,629
Average	15.1	21.8	22.6	18.5	22.0	2,716
At-least once	37.4	50.6	45.4	34.0	24.2	7,875

8.4 The distribution of the GPC households by Dependency ratio

Appendix table 2: Percentage of the GPC households by dependency ratio and survey period

Survey period	Dependency ratio							Number of households
	0<= DR <=0.5	0.5< DR <=1	1< DR <=1.5	1.5< DR <=2	2< DR <=2.5	DR > 2.5	No supporters	
1989/90	26.0	20.1	14.6	14.6	4.6	13.5	6.7	1,894
1990/91	27.4	20.3	12.9	13.4	4.7	14.9	6.5	1,966
1991/92	27.4	21.0	12.5	13.9	5.9	12.8	6.6	2,045
1992/93	28.0	19.7	12.9	14.1	4.7	14.0	6.5	2,001
1993/94	27.0	21.1	12.7	14.9	5.0	13.0	6.4	2,019
1994/95	26.2	20.8	13.4	15.0	5.7	11.9	7.1	1,971
1995/96	26.7	21.2	13.5	14.6	5.3	11.8	6.8	1,988
1996/97	25.9	21.0	13.5	13.7	6.0	13.0	6.9	2,011
1997/98	29.3	19.2	13.2	12.9	5.8	12.6	7.1	2,111
1998/99	27.8	21.7	12.0	13.3	6.5	12.5	6.1	2,152
1999/2000	28.0	20.7	12.2	13.6	5.8	12.7	6.9	3,433
2000/01	28.5	20.9	12.2	15.0	5.3	11.5	6.7	3,548
2001/02	27.6	21.4	12.8	13.9	5.3	11.9	7.1	3,492
2002/03	27.1	20.9	12.7	14.2	5.6	11.8	7.7	3,503
2003/04	26.8	20.5	13.6	14.5	5.0	12.2	7.4	3,489
2004/05	27.5	19.8	12.6	14.9	5.2	12.5	7.6	3,454
2005/06	26.2	20.5	13.3	14.5	4.8	13.1	7.7	3,422
2006/07	26.0	21.5	12.6	15.1	4.8	12.8	7.2	3,478
2007/08	27.1	19.9	13.1	15.5	5.0	12.0	7.4	3,629
Average	27.2	20.6	13.0	14.3	5.3	12.7	7.0	2,716
At-least once	61.0	49.2	33.3	36.9	17.2	26.0	11.5	7,875

8.5 The distribution of the GPC households by household head characteristics

Appendix table 3: Percentage of the GPC households by household head characteristics and survey period

Survey period	Household head characteristics											Number of households
	Resident spouse: child male head	Resident spouse: middle-aged adult male head	Resident spouse: older adult male head	Resident spouse: middle-aged adult female head	Resident spouse: older adult female head	Non-resident spouse: child male head	Non-resident spouse: middle-aged adult male head	Non-resident spouse: older adult male head	Non-resident spouse: child female head	Non-resident spouse: middle-aged adult female head	Non-resident spouse: older adult female head	
1989/90	0.0	44.8	11.8	1.5	0.2	0.0	13.1	4.5	0.1	14.7	9.3	1,894
1990/91	0.1	43.0	11.3	1.4	0.2	0.0	14.5	4.1	0.1	16.4	9.0	1,966
1991/92	0.0	44.1	11.1	1.6	0.1	0.0	15.3	4.2	0.1	15.0	8.5	2,045
1992/93	0.0	45.2	10.9	1.0	0.1	0.0	14.6	4.1	0.0	15.3	8.7	2,001
1993/94	0.0	44.2	11.1	1.1	0.1	0.1	13.9	4.1	0.1	16.0	9.1	2,019
1994/95	0.2	44.1	10.9	1.2	0.2	0.0	13.3	4.4	0.1	16.2	9.4	1,971
1995/96	0.1	44.9	10.9	1.2	0.2	0.1	12.8	4.3	0.0	16.2	9.4	1,988
1996/97	0.0	44.5	11.3	1.1	0.1	0.0	12.5	4.2	0.0	16.7	9.5	2,011
1997/98	0.0	44.8	10.9	1.3	0.2	0.1	13.6	4.3	0.0	15.8	9.0	2,111
1998/99	0.0	43.6	11.0	1.1	0.2	0.0	14.1	4.3	0.0	17.0	8.7	2,152
1999/2000	0.0	42.6	10.8	1.3	0.2	0.0	14.5	3.9	0.0	17.0	9.8	3,433
2000/01	0.0	42.9	10.3	1.0	0.1	0.0	14.8	4.0	0.0	17.2	9.8	3,548
2001/02	0.0	42.8	10.1	1.3	0.1	0.0	14.3	4.2	0.0	17.0	10.1	3,492
2002/03	0.0	41.8	9.5	1.2	0.2	0.0	15.2	4.1	0.0	17.2	10.7	3,503
2003/04	0.0	41.2	9.7	1.1	0.1	0.0	15.0	4.1	0.0	18.1	10.7	3,489
2004/05	0.0	41.7	9.5	1.4	0.2	0.1	14.3	3.8	0.0	17.8	11.1	3,454
2005/06	0.0	41.7	9.5	1.4	0.1	0.1	13.8	3.8	0.0	18.2	11.4	3,422
2006/07	0.1	39.9	8.5	1.0	0.1	0.1	15.0	4.0	0.0	20.2	11.2	3,478
2007/08	0.0	39.3	8.1	0.9	0.1	0.1	15.6	3.9	0.0	21.2	10.8	3,629
Average	0.0	43.0	10.4	1.2	0.1	0.0	14.2	4.1	0.0	17.0	9.8	2,716
At-least once	0.1	43.4	9.2	3.1	0.3	0.2	34.2	5.6	0.1	27.9	9.8	7,875

8.6 The distribution of the GPC households by Proportion of Male adults

Appendix table 4: Percentage of the GPC households by proportion of adult residents that are male and survey period

Survey period	Proportion of adults (aged 15-59 years) that are male						Number of households
	Prop = 0%	0% < Prop < 50%	Prop = 50%	50% < Prop < 100%	Prop = 100%	No adults aged 15-59 years	
1989/90	16.3	12.9	36.6	12.1	15.4	6.7	1,894
1990/91	18.2	11.9	36.9	10.4	16.2	6.5	1,966
1991/92	15.9	11.1	39.5	10.8	16.3	6.6	2,045
1992/93	16.7	11.0	38.1	11.4	16.2	6.5	2,001
1993/94	17.3	10.8	37.8	11.8	15.9	6.4	2,019
1994/95	17.6	10.5	37.3	12.5	15.0	7.1	1,971
1995/96	18.0	9.9	38.7	11.8	14.7	6.8	1,988
1996/97	17.6	10.9	38.6	10.8	15.1	6.9	2,011
1997/98	16.7	12.2	38.2	9.8	16.1	7.1	2,111
1998/99	18.4	12.1	37.1	10.4	15.9	6.1	2,152
1999/2000	17.5	11.1	37.3	10.2	16.9	6.9	3,433
2000/01	17.3	11.5	36.7	10.6	17.2	6.7	3,548
2001/02	17.4	11.9	36.1	11.3	16.3	7.1	3,492
2002/03	17.5	11.9	35.5	10.3	17.2	7.7	3,503
2003/04	18.0	12.9	34.9	10.0	16.9	7.4	3,489
2004/05	17.5	12.9	34.8	10.5	16.8	7.6	3,454
2005/06	17.8	13.1	34.9	10.7	15.9	7.7	3,422
2006/07	19.2	12.9	32.8	10.9	17.0	7.2	3,478
2007/08	19.7	12.6	32.5	10.7	17.2	7.4	3,629
Average	17.6	11.8	36.5	10.9	16.2	7.0	2,716
At-least once	32.3	23.7	55.1	21.2	37.9	11.5	7,875

8.7 The distribution of the GPC households by Age-sex distribution

Appendix table 5: Percentage of the GPC households by age-sex distribution and survey period; as well as the sex-distribution of the middle-aged adult only households

survey period	Age-sex distribution											Number of households	Middle-adult only households			Number of households
	Children only	Middle-aged adults only	Older adults only	Children + middle-aged female adults, no older adults	Children + middle-aged female adults + middle-aged male adults, no older adults	Children + middle-aged male adults, no older adults	Children + older adults only	Children + middle-aged female adults + older adults	Children + middle-aged female adults + middle-aged male adults + older adults	Children + middle-aged male adults + older adults	Middle-aged adults + older adults, No children		Male only	Female only	Male & female	
1989/90	0.1	15.8	4.0	7.5	45.8	2.1	2.6	5.5	10.8	2.4	3.4	1,894	61.3	9.3	29.3	300
1990/91	0.1	16.2	4.0	8.8	45.8	2.4	2.4	6.0	8.7	2.6	2.9	1,966	62.7	12.9	24.5	319
1991/92	0.1	17.1	3.5	7.8	47.0	2.2	2.9	5.8	9.0	2.1	2.5	2,045	64.5	8.6	26.9	349
1992/93	0.0	17.0	3.6	8.2	47.0	2.0	2.8	6.1	8.0	2.5	2.6	2,001	62.9	8.2	28.8	340
1993/94	0.2	15.8	3.6	8.1	47.4	2.4	2.6	6.1	8.0	2.7	2.9	2,019	60.0	11.9	28.1	320
1994/95	0.1	15.0	4.0	9.0	47.3	2.1	3.0	6.4	8.1	2.5	2.5	1,971	62.4	9.5	28.1	295
1995/96	0.0	16.0	3.7	8.4	46.9	2.3	3.1	6.5	7.7	2.2	3.2	1,988	56.1	13.5	30.4	319
1996/97	0.0	16.2	3.5	8.8	46.5	1.7	3.4	6.0	8.4	2.3	3.3	2,011	59.1	11.1	29.8	325
1997/98	0.1	16.7	3.6	8.2	46.6	1.9	3.4	5.5	8.6	1.9	3.4	2,111	62.0	11.6	26.3	353
1998/99	0.0	16.8	3.5	9.1	46.3	1.5	2.6	6.3	8.6	2.0	3.3	2,152	63.8	11.3	24.9	362
1999/2000	0.0	17.7	3.7	8.2	45.6	2.0	3.2	5.8	8.2	2.3	3.2	3,433	62.2	14.3	23.5	609
2000/01	0.0	17.8	4.1	8.1	46.3	1.9	2.6	5.8	8.1	2.4	3.0	3,548	64.7	14.1	21.2	632
2001/02	0.0	16.9	4.3	8.2	46.5	1.8	2.7	5.8	8.7	2.2	2.7	3,492	65.4	14.2	20.3	590
2002/03	0.0	17.2	4.8	8.4	45.4	1.8	2.9	5.6	9.2	2.3	2.4	3,503	68.8	16.1	15.1	603
2003/04	0.0	17.7	4.7	8.3	44.9	1.7	2.7	5.5	9.5	2.1	2.9	3,489	65.7	18.5	15.7	616
2004/05	0.1	17.4	4.7	8.2	45.0	1.9	2.8	5.3	9.8	2.3	2.6	3,454	64.2	18.8	17.0	601
2005/06	0.1	16.7	5.0	8.6	45.2	1.9	2.6	5.7	9.5	2.3	2.3	3,422	62.3	17.9	19.8	571
2006/07	0.1	16.6	4.9	10.2	44.5	2.2	2.3	5.7	8.4	2.6	2.7	3,478	64.4	17.1	18.5	579
2007/08	0.1	17.4	4.8	11.4	43.4	2.3	2.5	5.0	8.3	2.3	2.5	3,629	65.1	15.8	19.0	631
Average	0.1	16.7	4.1	8.6	46.0	2.0	2.8	5.8	8.7	2.3	2.9	2,716	63.0	13.4	23.5	459
At-least once	0.2	43.1	7.0	19.3	50.0	6.7	6.3	10.0	12.8	5.4	6.8	7,875	63.9	17.6	34.0	3,395

8.8 Distribution of the GPC households by their family structure

Appendix table 6: Percentage of households in all locations by family structure and survey period

Survey period	Family structure of households at all locations												Number of households
	Single person household: male	Single person household: female	Head + spouse(s), no biological children	Nuclear: head + spouse(s) + biological Children	Single parent: male Head + biological Children	Single parent: female head + biological Children	>2-generational household: upward extended	>2-generational household: downward +/- upward extended	Head + parent, no biological children	Skip generational household: downward +/- upward vertical extended	Sibling only	Head +/- others	
1989/90	10.6	2.7	6.5	41.4	4.0	8.2	0.7	14.0	0.5	7.0	1.6	2.7	1,894
1990/91	11.0	3.2	5.5	39.0	3.7	7.8	0.8	15.9	0.3	9.3	1.8	1.8	1,966
1991/92	11.1	2.5	5.6	39.2	3.4	6.9	0.5	16.9	0.2	8.8	2.2	2.6	2,045
1992/93	11.0	2.3	5.3	39.2	3.0	7.4	0.7	17.4	0.3	9.3	1.9	1.9	2,001
1993/94	10.2	3.3	4.8	39.1	3.2	7.2	1.0	17.7	0.3	9.7	1.6	1.9	2,019
1994/95	10.3	2.8	4.5	39.0	3.6	7.5	0.6	18.1	0.3	9.8	1.5	2.0	1,971
1995/96	9.9	3.1	5.5	38.4	3.1	6.9	0.8	17.7	0.3	10.4	1.8	2.1	1,988
1996/97	10.1	2.8	5.5	38.7	2.6	7.8	0.7	16.9	0.3	11.4	1.5	1.7	2,011
1997/98	11.0	3.3	5.4	39.4	2.8	6.9	0.7	15.8	0.3	11.4	1.4	1.6	2,111
1998/99	11.2	2.9	4.8	38.3	2.7	7.9	0.9	16.8	0.3	10.4	1.7	2.1	2,152
1999/2000	12.0	3.5	4.5	38.7	2.7	8.7	0.9	14.9	0.2	10.7	1.7	1.5	3,433
2000/01	12.3	3.8	4.3	38.7	2.5	9.0	0.9	15.1	0.3	9.6	1.9	1.7	3,548
2001/02	12.2	3.9	3.8	38.7	2.5	8.8	0.9	15.2	0.1	9.8	1.5	2.4	3,492
2002/03	12.9	4.2	3.2	38.1	2.6	8.7	1.1	14.8	0.2	10.4	1.3	2.5	3,503
2003/04	13.0	4.8	3.2	37.1	2.6	9.2	1.1	15.0	0.1	10.1	1.5	2.2	3,489
2004/05	12.8	5.1	3.1	37.4	2.6	8.7	1.2	15.6	0.1	10.5	1.2	1.6	3,454
2005/06	11.8	4.8	3.3	36.8	2.5	9.3	1.2	16.1	0.1	10.7	1.3	2.0	3,422
2006/07	12.1	4.5	2.7	34.9	3.4	10.5	1.2	16.4	0.2	10.6	1.2	2.3	3,478
2007/08	13.0	4.1	3.1	33.9	2.9	11.1	1.3	15.8	0.2	10.7	1.4	2.4	3,629
Average	11.5	3.6	4.5	38.2	3.0	8.4	0.9	16.1	0.2	10.0	1.6	2.1	2,716
At-least once	28.0	9.5	15.2	42.2	7.5	18.1	2.2	19.5	0.8	13.8	5.9	8.6	7,875

Appendix table 7: HIV infection by age group and sex of the residents in the GPC setting

Survey	<15	15-29	30-49	50-59	60+	Female	Male	Total
1989/90	33	186	121	18	17	209	166	375
1990/91	34	183	126	17	20	206	174	380
1991/92	36	182	138	18	14	203	185	388
1992/93	34	165	136	19	13	194	173	367
1993/94	29	150	135	20	13	183	164	347
1994/95	21	136	133	20	10	183	137	320
1995/96	13	125	123	20	9	161	129	290
1996/97	10	131	139	14	8	168	134	302
1997/98	9	119	154	17	6	172	133	305
1998/99	9	106	162	18	7	174	128	302
1999/2000	38	154	240	22	12	263	203	466
2000/01	36	160	229	29	13	261	206	467
2001/02	42	152	240	28	17	274	205	479
2002/03	45	149	242	27	18	284	197	481
2003/04	62	158	263	30	24	325	212	537
2004/05	70	143	300	33	20	345	221	566
2005/06	73	135	316	48	16	359	229	588
2006/07	82	142	331	44	15	376	238	614
2007/08	90	164	340	53	18	418	247	665